

COMMUNITY TELECOMMUNICATIONS ASSESSMENT

Prepared for:

**Flagstaff, Page, and Williams in Coconino County
The Hopi Tribe in Coconino County
The Navajo Nation in Coconino County
Parker in La Paz County
Safford, Pima, and Thatcher in Graham County
Show Low, Pinetop-Lakeside, Snowflake, and Taylor in Navajo County
Sierra Vista in Cochise County**

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This Report is confidential and is intended solely for the communities participating in the Arizona Community Telecommunications Assessment, the Greater Arizona Development Agency (GADA), and the Arizona Department of Commerce.

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EXECUTIVE SUMMARY

Introduction

This Report presents the findings of the Community Telecommunications Assessment. In particular, it describes [i] existing and planned telecommunications capabilities and [ii] telecommunications needs for the following study area:

- Flagstaff, Page, and Williams in Coconino County;
- the Hopi Tribe in Coconino County;
- the Navajo Nation in Coconino County;
- Parker in La Paz County;
- Safford, Pima, and Thatcher in Graham County;
- Show Low, Pinetop-Lakeside, Snowflake, and Taylor in Navajo County; and
- Sierra Vista in Cochise County.

Capabilities Assessment

Consultations were held with infrastructure and service providers with the potential to influence telecommunications services available within the study area. These consultations identified a number of important realities relating to transport and local access.

Of note, the existing capacity of digital transport routes to some communities is not sufficient to support additional broadband traffic volumes, and this is an important challenge they must overcome. Transport capacity constraints appear to be limiting telecommunications development in Sierra Vista, Safford and area, Show Low and area, Page, and Williams. Overcoming this transport capacity challenge could require market, regulatory, or public funding solutions, and these options should be considered in the Department of Commerce's forthcoming Broadband Technology Study given that they may also affect other communities in Arizona.

Some significant differences in the availability of broadband access services also exist among the communities in the study area. Two fundamental realities have become evident.

First, in terms of broadband access services, there tends to be a number of broadband opportunities within most communities. For example, many communities have some digital subscriber line and/or cable modem coverage, as well as availability of T1 connectivity. However, these opportunities are not universal. Services tend to be focused on the community cores, and residents and businesses in suburban and rural areas have fewer broadband options, or perhaps no options.

Second, other telecommunications issues beyond broadband connectivity are important in the communities. For example, a number of the communities within the study area have substantial basic telephone service and cellular telecommunications deficiencies that appear to be a detriment to economic growth. Challenges relating to the timely availability of T1 connectivity are also a major issue in some communities, stemming from the inadequacy of basic plant and transport.

Descriptions of the available infrastructure and services in each community are found in **Sections 4** through **10** of this Report.

Needs Assessment

Discussions were held with major telecommunications users in each study area (except within the Hopi and Navajo territories). Descriptions of the needs articulated in each community are found in **Sections 4** through **10** of this Report. Three over-arching findings resulted from these needs consultations.

First, telecommunications opportunities, and broadband in particular, are significantly greater than perceived within the community. The consultations identified that more options for broadband connectivity exist, and several communities do not significantly lag the rest of the world with respect to high-speed service availability (though, as described above, some gaps may occur outside the community cores). This “grass-is-greener” phenomenon is prevalent in many communities across North America.

Second, differences exist in the extent that end-user groups are served.

- In nearly all the consultations with public agencies, a high degree of satisfaction was expressed with current services. This may be due to the “clout” of those agencies and their revenues, ensuring that they receive priority treatment from service providers.
- Larger businesses often had the services they needed through wired or wireless means, but were sometimes concerned over the timely availability of T1 connectivity. Smaller firms are very much dependent on being near a wire center for DSL coverage, or being in an area served by a reliable wireless operator.
- A similar picture exists for citizens. Those in urban cores (e.g., Flagstaff, Parker, Show Low, Sierra Vista) may have access to one or more wired broadband service option, but those citizens outside the urban core tend to be limited to dial-up access.

Third, a missing piece of the puzzle in many communities is the availability of a local telecommunications “champion”. Experience shows that these champions can play an essential role in cultivating the demand for broadband services, spearheading funding applications in the form of grants from State and Federal bodies as well as not-for-profit donors, and in organizing efforts to dialogue with providers with the aim to secure infrastructure investments.

Looking to the Demand Side

An initial component included in the Community Telecommunications Assessment project plan was a “demand survey”. The demand surveys would identify the broadband services desired within each community, as well as the willingness-to-pay for those services. The ultimate intention of the surveys would be to attract the attention of service providers by demonstrating the presence of sufficient demand to support a business case for infrastructure and service extension.

Demand surveys were developed as part of this Community Telecommunications Assessment, though the demand survey approach has a number of limitations.

- *First*, the surveys might not help solve the transport capacity problems, since they are aimed at end-users and local access.
- *Second*, the surveys might not solve the local access problems in cases where providers do not see compelling business cases for investments in today’s cash-constrained industry.
- *Third*, a number of small, rural, and remote communities appear not to have the resources to implement the surveys, and may require assistance from the State in this respect.

It is important to consider these realities in future Phases of the Arizona Community Telecommunications Assessment program.

1 INTRODUCTION

1.1 Background

The Greater Arizona Development Authority (GADA) has identified telecommunications infrastructure and service availability as a key driver of economic and social development. Yet not all communities in Arizona have access to the level of telecommunications services – particularly broadband access services – needed to generate economic and social growth. As such, GADA expressed an interest in conducting a “pilot study” to assess broadband telecommunications capabilities and needs at the community level. GADA subsequently allocated financial support to allow seven groups of communities to conduct telecommunications assessments, namely:

- Flagstaff, Page, and Williams in Coconino County;
- the Hopi Tribe in Coconino County;
- the Navajo Nation in Coconino County;
- Parker in La Paz County;
- Safford, Pima, and Thatcher in Graham County;
- Show Low, Pinetop-Lakeside, Snowflake, and Taylor in Navajo County; and
- Sierra Vista in Cochise County.

In November 2001, the City of Flagstaff coordinated efforts among these communities and issued a Request for Proposal (Number 22023) with the objective to select a consulting firm to perform the community telecommunications assessments. The original objective stated in the RFP was to consist of the following tasks:

- conduct a needs assessment focusing on demand measurement;
- prepare an inventory of high speed telecommunications infrastructure;
- identify specific telecommunications infrastructure technology alternatives;
- develop estimates of the costs of these alternative technologies;
- review and assess alternative financing mechanisms; and
- review and assess Federal, State, and local policy issues.

The objective, reflecting the available budget, was later scaled back to include the first and second of these tasks. A competitive bidding process, including consultant presentations to the Client, ensued. The Acres Pacomm Telecommunications Consulting Group, consisting of Acres Management Consulting Ltd. and Pacomm Consulting Inc., as well as Telecom Resources International, Inc. (TRI) and TeleCommons Development Group (TDG) as sub-contractors, were selected as the consultants-of-choice.

The remainder of this Community Telecommunications Assessment Report documents the results of the needs assessment and infrastructure inventory.

2 CONSULTATIVE APPROACH

The chosen approach to this study effectively utilizes two “streams” of information to delve into community telecommunications capabilities and needs. These streams are:

- consultations with infrastructure and service providers; and
- needs consultations with residential, business, and public agencies.

The import of these streams is that they provide a means for verifying potentially disparate inputs from the supply (provider) and demand (user) sides. Indeed, a number of instances of diverging perspectives were found in each community.

2.1 Infrastructure and Services Inventory

This section of the report deals with the collection, analysis, and presentation of data covering the telecommunications infrastructure and service availability required to support high-speed access and data services within a community. The infrastructure and services inventory was developed through consultations with providers. In addition, meetings were held with stake holders who could have some influence over the infrastructure and service availability in the State, among them the State regulator, the Arizona Corporation Commission (ACC).

Appendix A provides a list of those service providers and infrastructure owners and operators that were consulted in the development of the inventory.

Most, but not all, service providers responded to the request to provide information concerning transport and local infrastructure in these communities. Prominent among those that did not opt to participate was Citizen Communications that owns and operates both Frontier Communications serving the White Mountain region (Show Low, Pinetop-Lakeside, Snowflake, and Taylor) and Navajo Communications serving the Navajo Nation territory.

The infrastructure inventory data itself is portrayed in this report, captured in spreadsheets in MS Excel and MS Access database formats, and graphically portrayed on maps in MapInfo format. The Excel spreadsheet, the MS Access database, and the various maps are contained on a CD ROM accompanying this report. This CD also contains a complementary MapInfo Viewer that allows manipulation of the maps to a greater or lower detail, as desired.

2.2 User Needs and Demand

A two-pronged process was followed to [i] identify user needs and [ii] estimate the demand for broadband services.

User Needs

A consultative approach was employed, and in-person interviews were held with major telecommunications users in each community (except for those within the Hopi Tribe and Navajo Nation, which did not participate in the needs assessments). Major telecommunications users included a mix of businesses and public institutions (such as hospitals, schools, and colleges, community IT departments, and telecommunications task forces). In this manner, information was obtained to both understand unmet telecommunications needs, as well as to corroborate information collected as part of the consultations with infrastructure and service providers (see **Section 2.1**).

These consultations were arranged through representatives of the communities participating in the study. A listing of these contacts is provided in **Appendix A**. An average of about eight formal consultations were held in each community, plus solicitations of opinions through casual street-level contact with residents and business owners. These user need consultations focused on the largest communities, and not the smaller surrounding communities. For example, the majority of user consultations in Graham County were with businesses and agencies located in Safford, and in consultations in Navajo County focused on Show Low.

In addition, an “Issues Survey” was prepared and delivered to the communities for implementation. The results of the Issues Survey are presented in this report, and shed insights into perceptions of the relative importance of various aspects of telecommunications in each community. Again, the Issues Surveys were focused on the larger communities within each group (Flagstaff, Parker, Safford, Show Low, and Sierra Vista), under the assumption that these could best mobilize to generate inputs.

Broadband Demand

Survey instruments focused on measuring the demand for broadband services within individual communities were developed. These surveys aim to prepare estimates of the potential uptake of broadband services, and the associated willingness-to-pay for those services. The expectation is that, armed with this information, communities would be better positioned to negotiate with providers for the acceleration of deployment of broadband infrastructure.

The survey instruments (for residents, businesses, and public agencies) are complete, and some of those communities may opt to implement the survey. The results of the surveys, if implemented, will be reported separately from this Report given uncertainty over whether individual communities will implement the survey and the length of time needed to complete the survey implementation. As such, the demand for broadband services as such is not discussed further in this report.

2.3 Limitations of Methodology

This approach to the Community Telecommunications Assessment brings with it a number of advantages and disadvantages.

The development of the infrastructure and service inventory comes with five provisions.

1. Attempts were made to ensure that consultations were held with all major providers, for example by searching databases and the Internet. However, definitive listings were not found that identify the providers within an area.¹ As such, the user needs consultations included a component for identifying providers of wired and wireless services within each community group.
2. Cooperation on the part of providers was voluntary. No regulatory or other channels were pursued to ensure that providers made information available as part of this study. In the majority of cases, providers voluntarily opted to participate in the study. In at least one instance, however, a major telecommunications provider opted not to participate.
3. Community infrastructure and service capabilities were gathered based on verbal inputs from providers. No formal process was employed to secure affidavits or other written confirmations that data are accurate. However, attempts were made to corroborate data, for example through discussions with users.
4. Even where a provider opted to participate in the study, detailed infrastructure routing information was often not available. For example, street level mapping could not be obtained because of security and business confidentiality concerns. While efforts were made to identify the approximate geographic bounds of some infrastructure and services, this reality will pose a challenge to communities in the future.
5. Certain data and information were provided to the consultants under the condition that it be treated as proprietary information and not to be divulged in a public document. This data is not presented at its base level, but is summarized and referenced as appropriate without violating requests for confidentiality.

¹ These databases include the Arizona Telecom Directory. The Directory lists providers that do not actually provide service in a given community.

User needs were identified based on verbal inputs from a sampling of users. This process comes with three provisions.

1. A limited number of residential, business, and institutional users could be consulted. In most community groups, this amounted to about eight or ten consultations lasting an average of about an hour. These consultations reflect only a subset of businesses and institutions with each community, and this sample coverage must be recognized.
2. Not all users are authorities on telecommunications needs. Attempts were made to speak with, for example, directors of information technology or presidents of businesses. In most instances, individuals were able to articulate some form of unmet need or describe a high level of service availability. In other cases, only general statements of capabilities or needs could be identified. This reality reinforces two themes: [i] a significant degree of uncertainty over what broadband opportunities exists; and [ii] telecommunications is complex topic, and requires a relatively high level of technical proficiency and some experience to understand.
3. Third, the consultative sampling was focused on large institutions and businesses. In many cases, these groups are relatively well served because each offers the potential to be a significant revenue source for providers. Residential and smaller business users can be expected to have greater frustrations relating to connectivity. It is expected that the local broadband demand surveys, being undertaken by individual communities, are the best way to understand the reality within each community as it pertains to all residents and businesses.

Finally, the methodology was used to examine broadband capabilities and needs within 14 areas of Arizona (Flagstaff, Page, Parker, Pima, Pinetop-Lakeside, Safford, Show Low, Sierra Vista, Snowflake, Taylor, Thatcher, and Williams, plus within the territories of the Hopi Tribe and Navajo Nation). These communities and areas are by no means representative of other areas of Arizona. In particular, they do not include:

- any of the ten largest cities in Arizona, which have a combined population of 3.2 million and represent 70% of the State's population; or
- any of the very small communities and expansive rural areas that exist with populations less than 2,000 persons and that represent less than 5% of the State's population.²

As such, the findings presented here cannot be readily extrapolated to other areas. Larger communities are expected to have a higher degree of broadband service availability, and it is expected that existing and emerging providers have invested significantly in services in these areas. The smaller communities and rural areas are expected to have somewhat fewer broadband options, if any.

² The study area does include a number of small communities within the Hopi Tribe and Navajo Nation.

3 OVERVIEW OF TELECOMMUNICATIONS CAPABILITIES

The following sections discuss the general availability of telecommunications infrastructure serving the study area. Capabilities specific to individual communities are described in **Sections 4 through 10**.

3.1 Inter-City Transport Capabilities

In this report, the term “transport” refers to the telecommunications infrastructure network that provides the connectivity to a community. “Transport” differs from “local access”, which refers to the local community telecommunications infrastructure that links individual users to the transport network.

It is noted that transport facilities provided over copper cable are not viewed as suitable transport to support broadband connectivity. Thus, there are two basic categories of insufficiency of transport: [i] lack of existing capacity on digital radio facilities; and [ii] insufficient transport capability of copper cable transport facilities.

The surveyed communities with the exception of Flagstaff, Parker and the Navajo Nation appear to be facing a significant shortage of transport capacity. It appears that most of the shortage in transport capacity can be traced to past attempts by Qwest Communications to divest itself of rural exchanges in Arizona. This divestiture ultimately did not take place, and in the interim infrastructure expansions did not keep pace with demand.

The main impact in the surveyed communities is on the transport infrastructure linking the communities of Sierra Vista, Safford, Thatcher, Pima, Page, and Williams with the telecommunications backbone. In addition, capacity available to communities in Frontier’s territory, such as Show Low, Pinetop-Lakeside, Snowflake, and Taylor is limited since the transport interface with Qwest in Holbrook on the Flagstaff to Winslow link appears to have insufficient capacity to accommodate additional traffic from Frontier.

Interviews with Qwest initially indicated that an aggressive construction program to expand capacity was planned, but that this program has subsequently been scaled back. The prognosis is that transport capacity relief in these areas will be slow in coming.

In addition, regulatory restrictions apply to a Local Access and Transport Area (LATA) structure that prevent an incumbent local exchange carrier (ILEC) , such as Qwest is, from utilizing the long haul facilities of an affiliate company that cross LATA boundaries to relieve transport deficiencies within a LATA.

Exhibit 3.1 identifies the applicable LATA of the surveyed communities:

Exhibit 3.1
LATA of Surveyed Communities

LATA	Name	Surveyed Communities within LATA
666	Phoenix	Flagstaff, Page, Williams, Hopi Tribe
668	Tucson	Sierra Vista; Safford, Thatcher, Pima in Graham County; Show Low, Pinetop-Lakeside, Taylor, Snowflake in Navajo County)
730	Los Angeles	Parker
980	Arizona Navajo Nation	Navajo Nation (Arizona)

There are two major transport corridors traversing the State of Arizona that contain fiber optics infrastructure owned and operated by national long haul telecommunications companies. These are installations along I-10 and the railway line operated by UPRR (Union Pacific Railroad) in the south and along I-40 in the north. The preponderance of these facilities is installed along the southern route and only AT&T Long Lines has installed fiber optics facilities along the northern route, I-40, with break-outs in Holbrook and Flagstaff. The AT&T facilities are the only existing potential source of relief to the transport constraint of the surveyed communities in the northern part of the State, primarily the White Mountain region. However, the AT&T facilities in Holbrook are completely utilized and AT&T indicated that there are no plans for expansion.

The impact of insufficient transport capability goes far beyond the ability of the incumbent service provider to deliver services. It also either restricts or denies the opportunity for the introduction of services by competing service providers. One good example of this impact is the roll-out of cable modem services by Cable ONE in the Safford area, which is being delayed in Safford, Thatcher and Pima until transport to the Internet backbone is available. Interviews with local Internet service providers also identified a frustration with the inability to expand and introduce value added services because of lack of transport capacity.

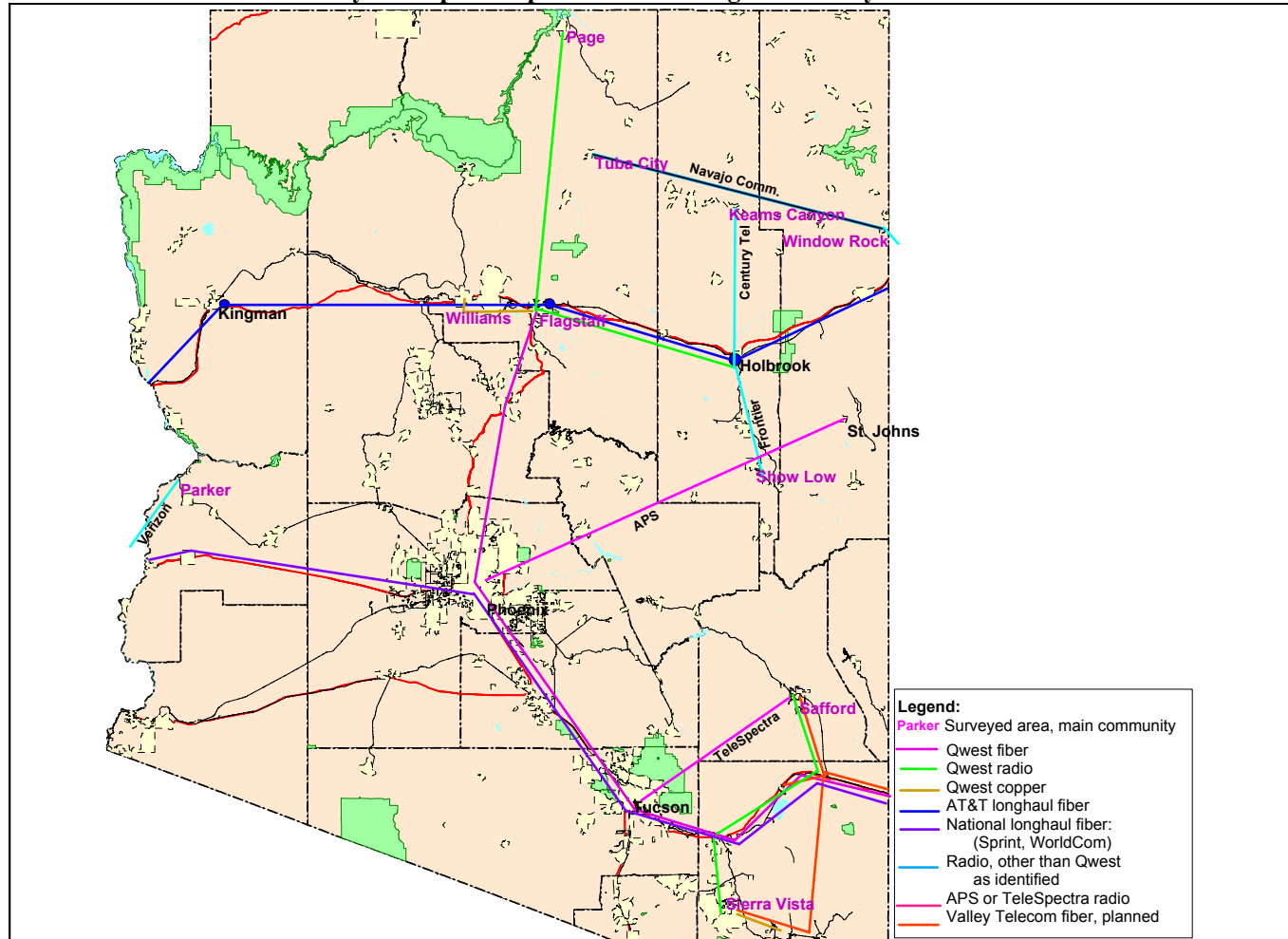
Other infrastructure owners and operators such as TeleSpectra and Valley Telecomm are in the process of installing facilities to serve several of the surveyed communities, primarily in the Sierra Vista and Safford areas. These operators may provide a key potential source of transport relief for these communities, however, the needed transport infrastructure is not yet in place.

Other potential transport providers exist, such as power companies, which could provide relief in some areas. The challenge is that the facilities of these companies do not route to the surveyed communities directly, and options to provide links from their terminal stations to the communities would need to be assessed and business cases made.

In addition, all surveyed communities lack redundant transport facilities (i.e., an alternative route for transporting voice, video, and data signals), and several have experienced lengthy outages over the past few years when the main link to the community was severed.

Exhibit 3.2 shows a map of the transport infrastructure serving the surveyed communities.

Exhibit 3.2
Inter-City Transport Capabilities Affecting The Surveyed Communities



3.2 Local Distribution

The primary distribution infrastructure in all communities is copper based. Flagstaff, Sierra Vista and Safford have several dedicated fiber optic cable runs to major users. These are shown on the detailed maps contained on the accompanying CD.

Qwest's attempt to divest itself of the rural exchanges in Arizona also affected the availability of local access facilities. In most communities, such as Sierra Vista, alternate access routing is generally not readily available, but it can be engineered often with the resultant impact of long lead times. In Safford, Thatcher and Pima the situation, though, is more severe. The copper distribution plant is exhausted to the point where additions to existing telephone services reportedly result in lead times of 12 months and more. This situation also impacts the provision of digital connectivity, since T1 service is commonly reliant on the availability of copper pairs to the end-user. Discussions with the ACC established that the State regulator monitors and enforces the provision of basic services, which cover a single residential telephone line and the first telephone line for a business, and that the organization has no jurisdiction to require the provision of additional services on a timely basis.

This double impact of insufficient transport facilities and local distribution plant can negatively affect the economic development of a region. This view is supported by consultations with community stakeholders that identified businesses opting to locate elsewhere as a result of telecommunications deficiencies.

3.3 High-Speed Access (Broadband Services)

Most of the surveyed communities with the exception of Page, Williams, and the Hopi Tribe have some form of wireline high-speed access available or planned, as summarized in **Box 3.1**.

The wireline high speed access services listed in the Box usually serve the core areas of a community, where distribution plant allows. Other areas of the community may be served by entrepreneurial wireless service providers. Most of them operate in the unlicensed 2.4 GHz band and a proliferation of several providers in one area can lead to interference.

Communities have taken different approaches to deal with this interference problem. For instance, in Graham County (Safford, Thatcher and Pima) a co-operative group was formed to allocate specific channels within the 12 channel range of 2.4GHz to each provider. Other areas, such as the White Mountain region (Show Low, Pinetop-Lakeside, Taylor and Snowflake) essentially manage the introduction of new wireless entrants by controlling access to municipal right-of-way and county owned towers. Larger wireless service providers, such as Cybertrails and CommSpeed take an engineered approach to minimize interference and utilize licensed and unlicensed spectrum as suitable.

Box 3.1: Overview of Wire Line Broadband and T-1 Access Availability***Sierra Vista***

ADSL services are available in Sierra Vista (within the nominal limits of 18,000 loop feet from the wire center). Cable modem service will be introduced once the transport capacity constraint to the Internet backbone has been resolved (and is scheduled to be introduced in the first quarter of 2003). Orders for new T-1 services requiring connection to the telecommunications backbone can experience delays pending the availability of transport capacity.

Safford, Thatcher, Pima

Cable modem service is planned, however, has been delayed several times due to a lack of transport capacity to Safford and is planned to be introduced in September 2002. No DSL services are available. Orders for new T-1 services requiring connection to the telecommunications backbone can experience delays pending the availability of transport capacity.

Show Low, Pinetop-Lakeside, Taylor, Snowflake

ADSL is offered in Show Low and Pinetop-Lakeside within its distance limitations, cable modem service is controlled and carefully monitored due to a lack of transport capacity into Qwest's backbone at Holbrook. Orders for new T-1 services requiring connection to the telecommunications backbone can experience delays pending the availability of transport capacity.

Flagstaff

ADSL and cable modem services are offered within the limitations imposed by the technologies. This, nonetheless, leaves some portion of the community unserved by wired broadband access.

Williams and Page

No ADSL or cable modem service is available at present or planned. Orders for new T-1 services requiring connection to the telecommunications backbone can experience delays pending the availability of transport capacity.

Parker

ADSL service is not available, though considerable coverage of the community (and Strip) by cable modem is available.

Hopi Tribe

Neither ADSL nor cable modem services are offered.

Navajo Nation

ADSL is offered in the main exchanges run by Navajo Communications. Cable modem service is not available.

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4 FLAGSTAFF

4.1 Overview

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The City of Flagstaff is located in northern Arizona and has a nominal population of about 60,000 with a summer seasonal increase of about 15,000. Its population, location, and amenities make it the regional center, with strong economic links to smaller neighboring communities and to Phoenix about 150 miles to the south. Flagstaff is the county seat for Coconino County, which with over 12 million acres, is the second largest county in the contiguous 48 states.

Flagstaff is a major junction point for travelers to the Grand Canyon and with a major highway link to Albuquerque, New Mexico to the east and Nevada and California to the west. The Burlington Northern Santa Fe railway corridor runs through the center of the downtown district, and Route 66 is still clearly evident in the city. The City is home for the Northern Arizona University, the largest single employer in the city, and the main campus of Coconino Community College. The City's economy is bolstered by tourism which is the largest sectoral employer in the region.

Flagstaff is seen as an attractive location from a lifestyle perspective to live and to work. An economic goal for Flagstaff is to raise the per capita income through a focus on growing and attracting higher income jobs to the area. Telecommunications is viewed as an essential component of a successful economic growth plan.

Exhibit 4.1 identifies the major telecommunications providers in Flagstaff.

Exhibit 4.1
Overview of Major Providers

Basic Telephone Service	Qwest
Cellular Telecommunications Service	Cellular One
Digital Subscriber Line Service	Qwest and Re-sellers
Cable Modem Service	Flagstaff Cablevision
Wireless Internet Service	InfoMagic, RediLynx (Niles Radio), Safe Stream (Safe Access)
Broadband Data Services	Qwest, AT&T, WorldCom, Sprint
Basic Telephone Service	Qwest

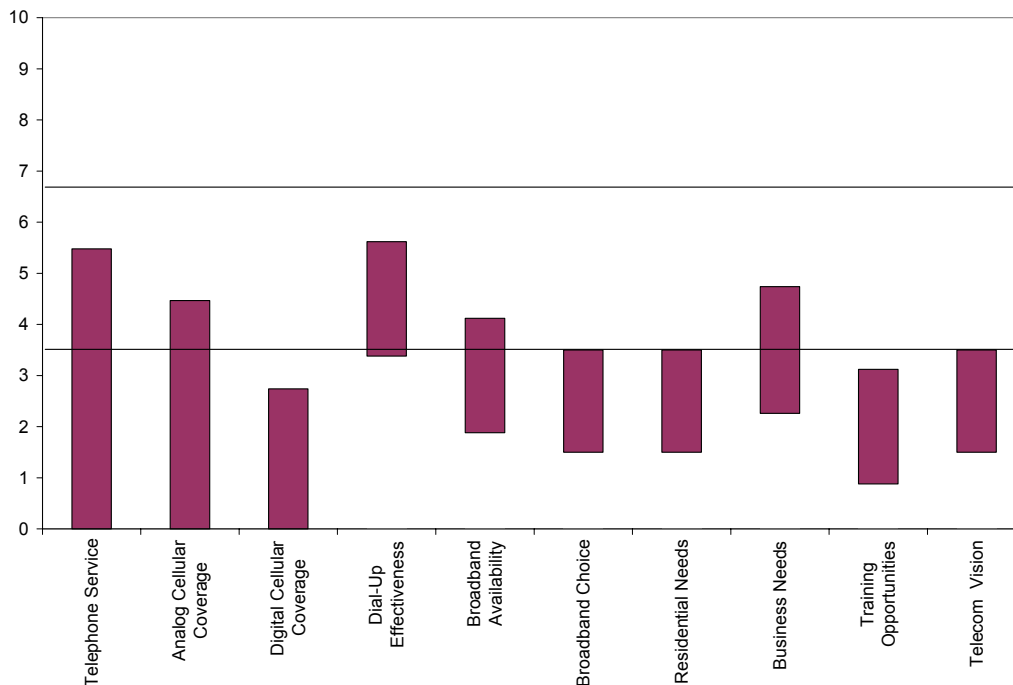
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4.2 Issues

An “Issues Survey” was completed for a sample of approximately a half dozen contacts within Flagstaff. The results of that survey are shown in **Exhibit 4.2**.

Survey respondents generally paint a dismal picture for basic telephone, cellular, and broadband communications in Flagstaff. The only telecommunications service that ranks as even adequate is dial-up Internet access.

Exhibit 4.2
Issues Survey Rankings – Flagstaff and Area



Note 1: Survey results show the mean results \pm one standard deviation.

Note 2: The survey results focus on Flagstaff, and not the surrounding area, Page, or Williams.

The results are based on a very small sample size, and in many cases do not appear to reflect the reality of telecommunications offerings in the area (based on consultations with local telecommunications users and providers). For example, it is expected that DSL and cable modem service is available to well over half of the local population. Based on this observation, it is suggested that the City of Flagstaff may wish to utilize the survey at a future time to secure a larger and more representative sample of views to help direct its telecommunications development initiatives.

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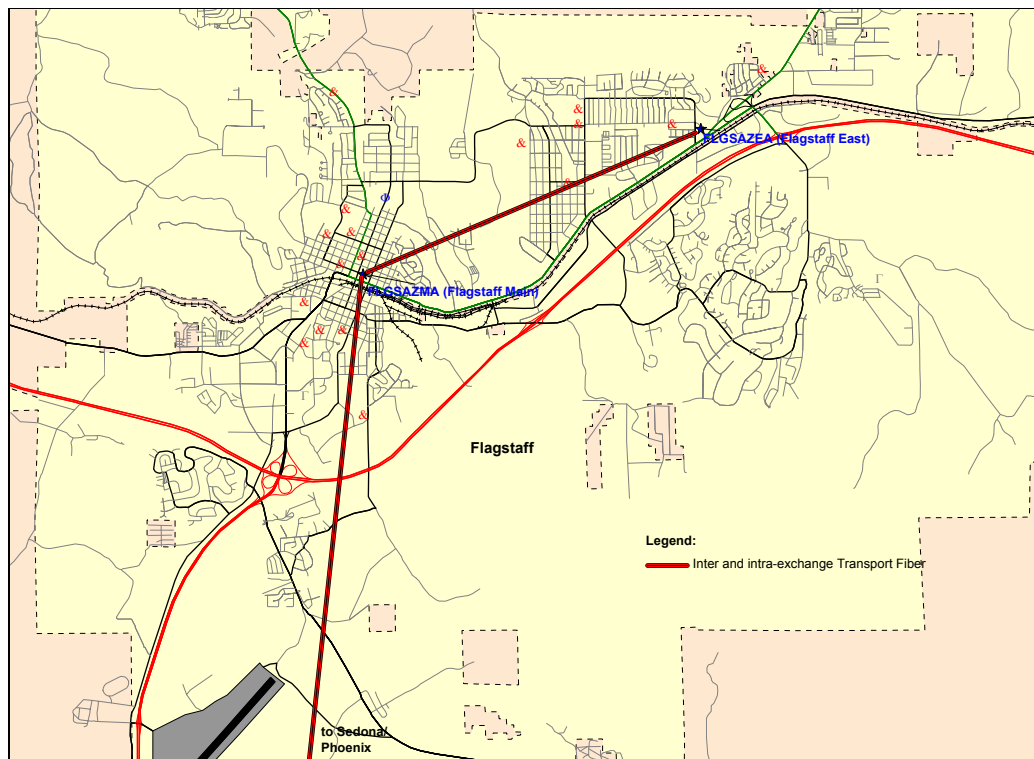
4.3 Capabilities

Flagstaff is located in the Phoenix LATA, Nr. 666. The exchange of Flagstaff is owned and operated by Qwest. It contains the wire centers (central offices) of:

- Flagstaff Main; and
- Flagstaff East.

The exchange of Flagstaff was not included in the list of rural exchanges planned to be divested by Qwest, and consequently did not experience the same degree of impact from limited funding supporting transport and local distribution infrastructure as other rural exchanges.

Exhibit 4.3
Flagstaff Exchange



The exchange of Flagstaff serves as the major hub to other Qwest exchanges and to other ILEC's in Northern Arizona. Most of these experience major constraints with transport facilities, as explained in the individual community sections within this report.

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4.3.1 Transport

Transport into the Flagstaff exchange is provided over a fiber optic cable facility linking to the telecommunications backbone in Phoenix. Qwest did not confirm any user reports of transport capacity shortages.

Qwest's facilities between Phoenix and Flagstaff are on a single route; i.e., there is no diverse route to provide redundancy in the event of a failure on the one route. A cut of the fiber optics cable near Sedona in 2001 resulted in lengthy outages affecting the Flagstaff exchange as well as other communities in Northern Arizona that are downstream of Flagstaff.

AT&T Long Lines has a presence in Flagstaff connecting to its national fiber optic facilities along I-40, crossing the State.

The Burlington Northern and Santa Fe Railway Company (BNSF) is planning to install a radio system along its rail line crossing Flagstaff. The eastern leg will only be completed to Winslow by the end of 2003, while the western link towards Los Angeles has not yet been funded. BNSF indicated that they are planning to lease bandwidth to unregulated service providers.

BNSF confirmed that there are no carrier fiber optic cable installations along its railway line in Arizona.

4.3.2 Local Access

The local distribution plant operated by Qwest is primarily copper based. However, there are also over forty dedicated fiber optic cable runs as shown on the detailed map included on the accompanying CD.

There does not appear to be any shortage of local distribution plant in Flagstaff.

Three local wireless Internet access providers operating in Flagstaff were identified. Their services are mostly concentrated on those areas not covered by Qwest's ADSL and Cablevision's cable modem services.

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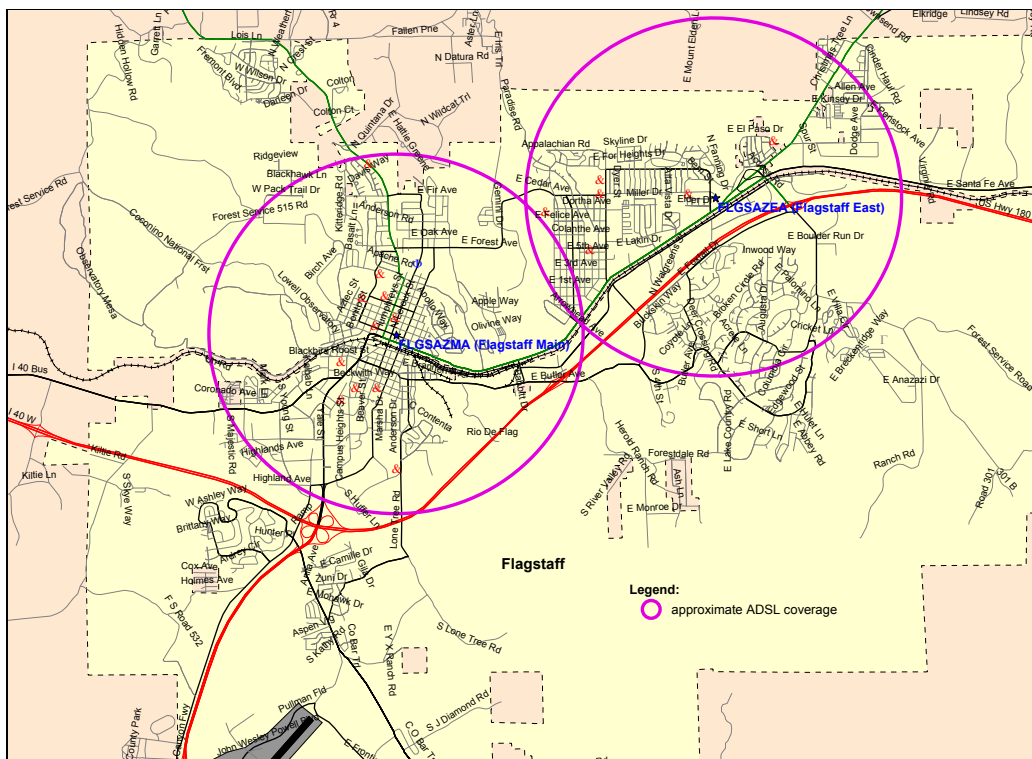
4.3.3 Services

Flagstaff is well-served with high-speed Internet services, as well as with ATM and frame relay services, in some areas. From Qwest's perspective, lead times for new orders are within the norm.

Qwest is offering ADSL service from its wire centers of Flagstaff Main and Flagstaff East within the nominal limitation of 18,000 loop feet from a wire center. The circles in **Exhibit 4.4** guestimate ADSL coverage based on 18,000 loop feet distance from a wire center.

Flagstaff Cablevision has upgraded its network to the standard necessary to support cable modem services and is offering cable modem services in those areas covered by its network. A similar depiction of Cablevision's network showing coverage by cable modem service is not available.

Exhibit 4.4
Flagstaff Exchange ADSL Coverage



Wireless service providers (e.g. Niles Radio) are extending broadband services to the fringe areas within the exchange that are beyond the reach of the existing ADSL and cable modem coverage. CommSpeed, located in Prescott Valley, is planning to enter the Flagstaff market in 2003 with its wireless broadband access service.

4.3.4 Internet Access Service Pricing

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Qwest's ADSL service is currently offered at \$49.95/month.

Residential cable modem service is offered at \$34.95/month to existing cable television customers and \$44.95 to those which are not cable television customers.

Wireless Internet access is priced according to the access speed. According to RediLynx (Niles Radio), the predominant wireless provider, the average access is 512 Kbps downstream priced at \$70/month with an equipment purchase of \$579 and a setup fee of \$180. RediLynx provides an "economy" service to a limited number of customers – 128 Kbps downstream at \$29.95/month with rental customer premise equipment.

There was an expectation, expressed through the consultations with telecommunications users, that these rates were unaffordable and higher than found elsewhere. However, these rates (DSL and cable modem) are similar to other larger and smaller communities in Arizona.

4.4 Needs

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A general theme expressed by stakeholders interviewed in the course of the consultations was that there is a need for a higher availability of high-speed Internet access services in the Flagstaff area. More specifically, although it may appear that high-speed Internet service is available throughout Flagstaff, in reality there are areas where neither DSL nor cable modem service is available, and an estimated 20-30% of households may not have access to wire line broadband services.

In areas where high-speed Internet services are not available, dial-up connectivity is reported to be of poor quality. The acquisition and analysis of data regarding the copper infrastructure in the Flagstaff area required to assess the extent of the coverage of high-speed Internet connectivity and transmission quality are beyond the scope of the current study and would in turn require the complete cooperation of Qwest and the cable operator to share internal data. The Department of Commerce may wish to have this issue addressed in future Phases of its Community Telecommunications Assessment Program.

A further need acting as a barrier to achieving the standard of telecommunications services essential to the businesses that Flagstaff wants to attract is the lack of diverse transport infrastructure to Phoenix. There have been instances of failures on the single fiber optic transport system that have resulted in the total outage of all communications with Flagstaff and other parts of Northern Arizona.

Examples of this service outage vulnerability are found at Infomagic's Web site:

"2 August 2001 The outages today from 8am - 1pm and from 4:30pm - 5:45pm were due to a cut fiber somewhere near Sedona. This fiber carries most of the traffic for the Internet in Northern Arizona as well as most Cell Phone service. Qwest spliced the fiber this morning and that "temporary" splice broke later in the day. A permanent repair is planned for sometime after 10pm Thursday."

<http://www.infomagic.net>

A redundant link is viewed as a high priority both to retain businesses that are becoming more and more dependent on telecommunications and to attract new businesses to the area.

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4.4.1 Residences

Residents in Flagstaff have a number of competitive alternatives for dial-up Internet access and high-speed Internet through ISPs such as, for example, cybertrails, InfoMagic and The River. Some concerns were voiced relating to the quality of dial-up Internet services, particularly regarding dial up speeds using a 56 kbps modem. The extent and severity of this service quality cannot be determined without more structured and in-depth research that is beyond the scope of this study.

Digital Subscriber Line services provide a high-speed alternative for those customers living within either of Qwest's DSL provisioning zones in the area – the Flagstaff Central Office and the Eastside Central Office. ADSL, the common technology used by the telephone companies to provide high-speed Internet service, is typically limited to cooper loop lengths up to 18,000 feet.

The specific demographics of the distribution of loop lengths for Flagstaff and area are not available to the Consultants, however, a study by the Pinkham Group covering Arizona indicates that there are approximately 24% of households served by DSL equipped central offices of the RBOCs that are beyond the reach of acceptable SDL service.³ This result, which is a smaller percentage than the approximately 30% that applies for all US households⁴, would lead one to conclude that a significant number of households – perhaps 25%-30% of the total – in Flagstaff and area do not have access to DSL service. This broad estimate is consistent with those presented above and derived from discussions with providers and ISPs.

³ Source: *Broadband Market Survey - DSL Availability of Incumbent Telcos - Q4 2000*, Pinkham Group

⁴ Source: Pinkham Group Web site - http://www.pinkhamgroup.com/c_reports.htm

A number of key stakeholders that were interviewed, including a major ISP, stated that the outside plant facilities (copper loops) in certain areas of Flagstaff are of poor quality (e.g., bridge taps, multiple splices, noisy) and that this significantly limits the effective coverage for DSL service, even within the nominal 18,000 copper loop feet.

Further information on the availability of DSL service to households in Flagstaff and views on the price of the service is expected from the residential survey that currently is a component of the study (the survey is pending Client approval).

Flagstaff Cablevision provides cable television service throughout Flagstaff and also provides high-speed Internet service using cable modems. Details on the coverage footprint of the cable plant were not available. Without provider data on coverage within the community, the survey instrument is the only way to assess the extent that these broadband access services are available within and across Flagstaff.

There were multiple broadband wireless service providers operating in Flagstaff, the largest of which is RediLynx (Niles Radio Communications). Discussions suggest that that RediLynx and SafeStream (Safe Access) are the two remaining wireless ISP providers. The wireless ISP market in Flagstaff is a niche market with only a few hundred customers as of September 2002.

4.4.2 Businesses

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The City of Flagstaff is aware of the shortage of water in the area and the limitation that this imposes on the types of businesses that could locate in the area. Since the manufacturing sector is constrained by the availability of water, the technology and services industries are priority targets for economic expansion in the area. These industries demand the availability of quality, high-speed connectivity provided at affordable prices.

Although T1 service is available across most of Flagstaff from Qwest, there are particular areas where it has been difficult to get T1 service (e.g., the airport before the City paid to have a fiber cable installed to the airport), and businesses in general are not satisfied with the response time to have T1 service delivered or transferred coincidental with a move of business locations. A number of sources indicated that there appears to be a disconnect between Qwest and the business community regarding the needs of business and the planning of Qwest's expansions.⁵

⁵ An example is the dialog at a meeting with Qwest and the business community called by GFEC on July 10, 2002.

In-person consultations were held with a half dozen businesses operating as independent entities or as part of larger chains. The comments from some of these businesses relating to telecommunications capabilities available to them were as follows:

- A small electronic commerce firm located in the suburbs of Flagstaff indicates that it is well-satisfied with existing services and options. It did indicate frustrations over the time required to install T1 connectivity, estimated at over 100 days. No concerns were voiced over uptimes, customer service, or price.
- A large manufacturing firm outside the core of Flagstaff has been served by a wireless provider. Service was reportedly down an average of 10%-20% of the time. No alternative broadband providers were reportedly offering service in the area, and the manufacturer has decided to move locations as a result.⁶
- A large e-commerce firm indicated that provisioning a T1 connection within the core of Flagstaff took approximately four months of elapsed time between ordering and service availability, and extensive time acknowledging and correcting problems. No other concerns were voiced, though the time to secure T1 connectivity reportedly had significant costs.
- A large multi-location manufacturing firm purchases significant bandwidth from a broadband provider. The manufacturing firm was reportedly given only one week to sign a long term contract extension at existing rates or face a significant increase in rates. Customer service and treatment challenges such as these are reportedly the norm.

Note that these discussions do not constitute broad coverage of Flagstaff's business community. Greater insights on unmet needs could be gathered through the implementation of the aforementioned demand survey.

4.4.3 Public Agencies

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The City of Flagstaff

The City of Flagstaff has built its own local telecommunications network that is augmented with circuits from Qwest. The City has a fiber "campus network" and a wireless network with a number of T1 circuits leased from Qwest to interconnect all City offices and locations to the central hub at City Hall. Internet interconnection is provided over a wireless link to NSU. The City's telecommunications needs appear to be well met with the private network in place today.

⁶ These service down times have reportedly had significant effects on operations, including staff down-time and customer migration. As a result, the firm is moving its operations to an area of Flagstaff with other broadband options.

Flagstaff City – Coconino County Public Library

The library is linked by fiber to City Hall, but this connection is used for administrative applications only. Internet connectivity is provided by NAU via a frame relay PVC (service from Qwest is called IPVC⁷). They expect to get a 60% rebate through E-rate. The library could get Internet access through the City via the fiber link, but choose to have a separate connection. A new branch at Coconino Community College is scheduled and it will be connected by the City via wireless to City Hall and on the fiber link to the library. The library considers the service from Qwest as quite good. Qwest reportedly is not good at initial setup, but there are few failures and Qwest will call before the library is even aware of a problem.

Before the library's future telecommunications needs can be determined the basic question needs to be answered – What is the role of the libraries in the future? They do see a need for additional bandwidth. The library notes that approximately 50% of users are in the low income category and the library provides their only means of accessing the Internet.

Coconino County

Coconino County has its own telecommunications network that is administered by the IS department in Flagstaff. The County arranged a deal with Flagstaff Cablevision for dark fiber amongst County buildings in the central area of Flagstaff. A number of County offices outside of the fiber ring are connected to the central location using T1s provided by Qwest under a special arrangement whereby the County paid a capital contribution to Qwest to install terminal equipment at the County office and in return the County enjoys a reduced flat rate for T1 connectivity throughout Flagstaff.

The Burlington Northern Santa Fee Railway will not permit track crossings, so the County has installed a pair of 100 Meg microwave radios to the LEIF (jail and juvenile probation center) on the south side of the tracks. The County also uses a number of copper alarm circuits (LADAs) obtained from Qwest equipped with County-provided FlowPoint routers to connect some of the offices.

The County has a Lucent/Orinoco spread spectrum wireless setup with a wireless link to Infomagic (located at the Monte Vista Hotel), who provide the Internet service to 300 terminals (600 accounts) via an omni-directional antenna at the County location.

The Sheriff's department office at Page is connected to the Flagstaff office via a T1 leased from Qwest. There is a leased T1 to Williams. Fredonia and Colorado City (actually in Mohave County, but is administered by Coconino County) will VPN connect to Flagstaff via an Internet dial-up account with the local ISP.

⁷ Qwest ATM/FR Interworking PVC (IPVC) - Qwest IPVC creates a connection between the ATM network and Frame Relay network. ATM to Frame Relay interworking is an option that allows customers to complement the high bandwidth transport capabilities of ATM with the cost-effective, narrowband data transport of frame relay in order to provide a seamless transition to a single, multiservice network.

The County's vision is for one central dispatch system for the County and this is expected to be in place in 5 years. The plan includes extending video conferencing and VOIP to all outlying areas and to add T1 circuits to support this. Video conferencing will support health care training (reduce travel) and distance arraignment. A minimum of 25 frames per second is mandated for distance arraignment and to support this on the Polycom IP video conferencing equipment that is in use requires broadband connectivity with higher speed than that supported with ISDN circuits. The County indicated that it would be prepared to extend connectivity to pseudo-County agencies, but not to private sector or residential users.

Two major barriers to broadband connectivity identified by the County are lack of fiber to Williams and Page, and the roadblocks to cross the Navajo nation. Price is definitely not an issue since their prices through arrangements with Qwest are extremely low. This may not turn out to be the case in the future for T1 circuits to outlying areas to support video conferencing.

The County reported that T1s from Qwest are quite reliable, however dealing with Qwest to get connections can be challenging. It appears fairly obvious to the County that there has been a reduction in funding for the area. The County gets the impression that the user is faced with building the business case for Qwest before they will agree to spend capital.

Northern Arizona University (NAU)

Northern Arizona University is both a user of telecommunications connectivity and a service provider of connectivity for the education sector within Arizona for distance learning and Internet access.

There are two networks provided under the auspices of NAU and Arizona University – the NAU Internet and NAUNet. The latter is predominantly a video conferencing network, but it has some limited data connectivity capability as well.

NAU Internet

Since 1990 the NAU Internet has been extending Internet access to community colleges, K-12 schools, non-profit entities, government entities, cities and counties.⁸

As an Internet service provider, NAU Internet has dual-homed Internet access, a DS3 with AT&T (25 Meg) and an OC3 from Qwest (25 Meg) and a separate connection to Internet II via a 25 Meg circuit on the Qwest OC3 ATM. There are approximately 40 sites in the state that connect to the NAU Internet using Qwest IPVC circuits. A network diagram is available at http://www.tel.nau.edu/network/topology/Internet20002_frame.htm.

⁸ See <http://aspin.asu.edu/about/mission.html> for the mission statement for ASPIN.

NAUNet

“Northern Arizona University is charged by the Arizona Board of Regents to deliver quality upper-division courses and undergraduate programs to all rural and, where specifically authorized, metropolitan counties, and to provide graduate education programs throughout the state. NAUNet is a tool to help carry out this statewide charge. NAUNet is a cost-effective way to deliver quality instruction from the residential campus in Flagstaff to sites throughout the state. At some sites, NAUNet supplements instruction delivered by on-site faculty. At other sites, NAUNet is the primary means by which instruction is delivered.” “With 34 active sites, NAUNet is the only network in Arizona linking public education and state agency facilities to one another and to many of the state's C-band and Ku-band satellite up-link services, and providing direct links to most of Arizona's major television broadcasting stations and several cable companies.”⁹

The NAUNet is an analog network that is designed to carry high quality video conferencing sessions. The analog microwave radio equipment for the network has been provided by NAUNet and the network is operated for NAUNet by Telespectra. Digital capacity has been obtained over the analog network using T1 modems. The plan is to move to a digital service, but there are issues of the trade-off of delay and bandwidth to maintain the current video quality. At this point, the NAUNet group thinks that it needs 45 Mbps bandwidth to maintain the current and expected quality of the videoconferencing network – “studio quality”. This will be totally uneconomic and they are expecting that recent compression algorithms and codecs will provide a service quality that will become accepted as the standard. Telespectra is planning to upgrade its network to digital. Pricing for the videoconferencing service is available on their Web site. Their service is available to outside groups at \$100/hr per location. The users use the existing equipped classrooms for the teleconference sessions.

This network was built using federal grants. There were a total of 6 grants totaling \$6 Million. The operating costs for this network are approximately \$900K per year. One of the major weaknesses of the network is the lack of redundancy.

Flagstaff Unified School District

The Flagstaff Unified School District (FUSD) administers three high schools, two middle schools, 12 elementary schools and an alternative school (New Start) for high school or elementary school students requiring special attention.

All schools are connected to the Administration Center via T1 over fiber infrastructure provided by Qwest through a DS3 access. Internet connectivity to all schools is provided through NAU over a single T1 access from the Administration Center. This network supports approximately 4,000 computers with an average of 1,500 concurrent computer sessions. Administrative usage varies by the time of the month and on average accounts for approximately 15-20% of the traffic load. The prime traffic on the network is from the high school computer labs access the Web.

⁹ A map of NAUNet is available at <http://www.nau.edu/naunet/nnsitemap.html>.

The FUSD connects to the Internet via a T1 to NAU, contracted through the Arizona Public School Computer Consortium (APSCC)¹⁰. This link is “slow” and viewed as inadequate to meet current connectivity demands, let alone future needs. Apparently, connectivity to the NAU network through the APSCC service is limited to a T1. Consequently, FUSD is looking at other options for higher bandwidth Internet connectivity.

FUSD would like to offer services to both schools and to students and teachers from their homes through FUSD, but consider this infeasible at this time due to the lack of adequate connectivity. Connectivity is constrained in two areas – from FUSD to the world and from homes to FUSD. One major example of the services that FUSD would like to offer is some of the services available from the Cox Education Network ASP that was funded by the Arizona School Facilities Board.¹¹ However, some of the applications are bandwidth intensive and current broadband connectivity in the Flagstaff area is viewed as inadequate. Although high-speed Internet service is available in much of Flagstaff from Qwest and Flagstaff Cablevision, there are significant areas where this service is not available and many areas where dial-up access connection speeds, even at 28.8 Kbps, is not consistent. One area cited is an approximate 400 home development on West University Avenue with no cable modem or DSL high-speed Internet services available today.

The general understanding is that the outside plant (copper distribution wire) in many areas of Flagstaff and the switching equipment has not been kept current and as a result, this presents a deterrent to providing widespread, quality high-speed Internet service. This school district suggests that the State government should invest in a full-scale analysis of the telecommunications infrastructure in Flagstaff and in many of Arizona’s smaller communities.

United States Geological Survey (USGS)

The Government paid Qwest to install a fiber link to the USGS site from the Qwest Forest Avenue building. There are dual fibers in a common conduit. The fiber is equipped with an OC3 terminal and USGS has a DS3 access circuit. Qwest provides a T1 to the Jet Propulsion Laboratory in Pasadena, California and there are T1s to four observatories in the Flagstaff area. The observatories have Internet access through the JPL access to NASA.

The USGS head office administers the telecommunications, so the Flagstaff office is not generally directly involved with the purchasing decisions and pricing would reflect the bulk purchase leverage of head office.

¹⁰ “Arizona Public Schools Computer Consortium is a cooperative venture of member school districts in Arizona, authorized by a cooperative purchasing agreement among public school districts, charter schools, county school superintendents, and Northern Arizona University.”
<http://apscweb.apsc.nau.edu/services/director/APSCC%20Brochure.pdf>

¹¹ See <http://www.coxednet.org/vision.html>.

The USGS Internet access is a DS3 on GEONet (private USGS network). There are dual Internet portals, one at Menlo Park, California and one at Reston, Virginia, each with dual DS3s. The Flagstaff USGS field office can burst to DS3 on its Internet access. The office was formerly on DOINet (Department of Interior Network), but there was some internal disagreement within DOI and the contract was terminated last year. USGS reported that it is very satisfied with the quality of service provided by Qwest. The OC3 has not failed in the 9 months since it has been installed.

In summary, the telecommunications needs of the Flagstaff USGS field office are highly met.

4.5 Page

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4.5.1 Capabilities

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The community of Page is located in the Phoenix LATA Nr. 666. It is served by two exchanges:

- Page Main, owned and operated by Qwest Communications and providing wire line connectivity; and
- Page 07, operated by Southwest Wireless, Inc. serving the cellular user community.

As described in **Appendix B**, Qwest, after the take-over from US West, attempted to sell its rural exchanges in Arizona, including Page. Citizen Communications showed some interest, however, the sale did not materialize.

In the meantime Qwest did not invest in the upgrade of local nor transport infrastructure in the affected exchanges, leading to the infrastructure bottlenecks and long lead times to provision service currently encountered in these exchanges.

4.5.2 Transport

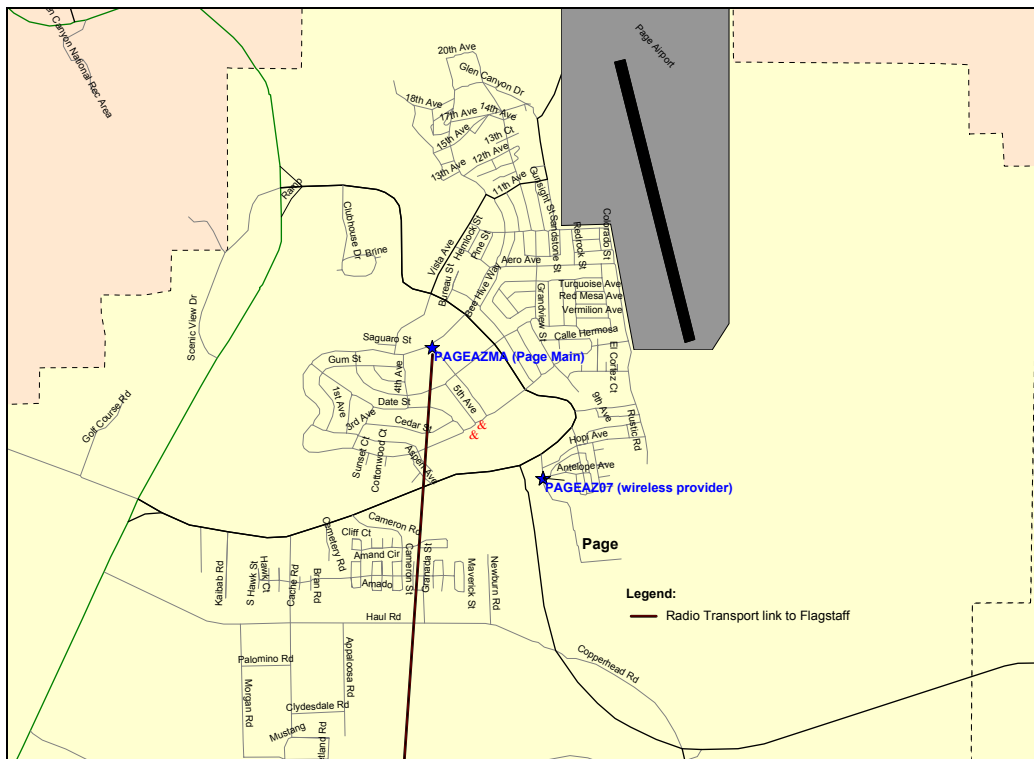
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Transport into the Page exchange is over a digital radio link between Page and Flagstaff where it is interconnected to Qwest's fiber transport network to Phoenix. The radio transport link to Flagstaff is completely exhausted and additional service orders requiring connection to the telecommunications backbone facilities usually need to wait for a cancellation of an existing service to free up bandwidth.

The radio transport facilities were scheduled to be replaced by a fiber optics cable run between Page and Flagstaff to expand the transport facilities into the community. This plan is reportedly currently on hold.

Exhibit 4.5 shows these transport capabilities.

Exhibit 4.5



This lack of transport facilities adversely affects not only the economic development of the region but also the timely introduction of enhanced services such as cable modem service on Cable ONE's local cable distribution network. Local Internet access service providers expressed frustrations with the inability to grow their networks and to introduce high speed access services which require additional transport capacity to the Internet backbone.

In addition, Qwest's facilities are single-routed; i.e., there is no diverse route to provide redundancy. No firm plans for expansion of capacity to Page were identified.

4.5.3 Local Access

The local distribution plant operated by Qwest is primarily copper based. Qwest does not have any local fiber cable runs in Page.

Several local entrepreneurs offer wireless access services in the unlicensed 2.4 GHz range to major users in the community.

4.5.4 Services

High speed data services up to T-1 level are offered in Page. ATM service is not available. Due to transport capacity problems, orders for new services reportedly have long lead times.

Qwest is not offering ADSL service in Page.

Cable ONE has not upgraded its network to be capable of carrying cable modem services and is not planning to introduce cable modem services in Page in the near future.

Several Internet service providers offer wireless access at tiered rates.

4.5.5 Internet Access Service Pricing

ADSL and cable modem access services are not available in Page.

Wireless is rated by speed. Typical rates are:

- \$45/month for 128 Kbps;
- \$65/month for 256 Kbps; and
- \$85/month for 512 Kbps.

A setup fee averaging \$150 also applies.

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4.5.6 Needs

Page would like to see the development of technology-based businesses to reduce the reliance on the tourism industry. These businesses require advanced telecommunications capabilities, which are presently not available. Anecdotal evidence suggest that businesses considering the area have investigated the existing telecommunications services, and chose to relocate elsewhere.

Some issues with basic telephone services were reported within Page. Among these were recurring problems completing local telephone calls and securing a dial tone. It is reported that satisfactory resolution of the problems have not been delivered by the incumbent provider. In addition, new telephone service installations reportedly are prolonged, sometimes taking more than several months.

Residences are served by a number of dial-up Internet service providers. No DSL or cable modem services are available, and as such an unmet need exists for the approximately 7,000 residents of the community. Some broadband wireless services (2.4 GHz) are reportedly available though firms such as TechData, Canyon Country, and OmniNet.

Anecdotal evidence also suggests that businesses have experienced difficulties, primarily in terms of long delays, in securing T1 connectivity. Other options, such as DSL and cable modem, are unavailable, so a significant unmet need exists.

Page has its own wireless network serving municipal facilities (spanning the City Hall, Fire Department, Police Department, Public Works Department, Water/Sewer Department, Youth Center, Library, and Airport. The network is reportedly adequate for meeting the City's needs.

Some significant challenges are reported in terms of communicating needs to the incumbent telephone company. For example, the incumbent provider reportedly would not return calls from City economic development officers investigating whether the capability to support a large call center within Page. Furthermore, the City has reportedly addressed questions related to the capacity of the existing link that have gone unanswered.

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4.6 Williams

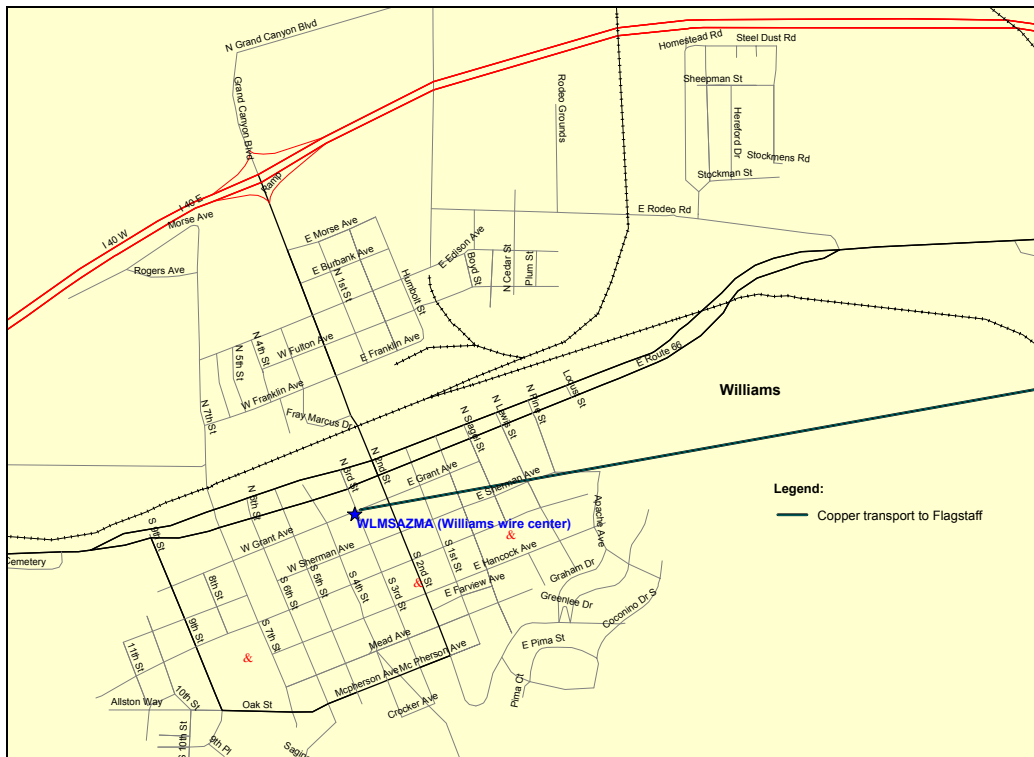
4.6.1 Capabilities

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The community of Williams is located in the Phoenix LATA Nr. 666. It is served by one wire center owned by Qwest Communications.

Exhibit 4.6 shows Williams and its wire center.

Exhibit 4.6
Williams



As described in **Appendix B**, Qwest, after the take-over from US West, attempted to sell its rural exchanges in Arizona, including Williams. Citizen Communications showed some interest, however, the sale did not materialize.

In the meantime, though, Qwest did not invest in the upgrade of local nor transport infrastructure in the affected exchanges, leading to the infrastructure bottlenecks and long lead times currently encountered in these exchanges.

4.6.2 Transport

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Transport into Williams is over copper facilities to the Flagstaff Main exchange where it is interconnected to Qwest's fiber transport network leading to Phoenix. The digital capacity on the copper link to Flagstaff is completely exhausted and additional service orders requiring connection to the telecommunications backbone facilities usually need to wait for a cancellation of an existing service.

Qwest's facilities are not backed up by any arrangement for redundancy with other transport providers.

Relief from Qwest though future investments is not expected in the near future as explained in **Appendix B**.

4.6.3 Local Access

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The local distribution plant operated by Qwest is primarily copper based. Qwest does not have any local fiber cable runs in Williams.

There are no local wireless Internet access providers located in Williams, although, Niles Radio has two connections from its Flagstaff base extending to users in Williams.

4.6.4 Services

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High speed data services up to T-1 level are offered in Williams, however, new connections experience long lead times due to transport capacity problems.

Qwest is not offering ADSL service in Williams.

The local cable company, Eagle Cablevision, does not have any plans to introduce cable modem services in Williams in the near future.

There are no local wireless Internet access providers in Williams.

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4.6.5 Needs

Basic telephone service in Williams was described as being of a high quality and reliability. No difficulties were uncovered relating to service, or service changes or additions

Residential Internet users have no options for high-speed Internet service in Williams. Neither DSL nor cable modem is available, and no broadband wireless providers were identified. As such, a significant deficiency exists here, though one which reflects the realities of the market size (population of about 3,000).

The same situation exists for businesses, except those wishing to purchase T1 or fractional T1 connectivity through Qwest. Discussions suggest, however, that few T1 lines serve the community, reflecting the size and nature of businesses. It was reported that an order for a T-1 circuit placed by Williams High School. It apparently took twelve months for this order to be filled due to a lack of transport capacity to Flagstaff. Funding for this facility was in danger of being lost and only pressure by the Northern Arizona Greater Flagstaff Economic Council led to a completion before loss of funding.

A major concern in the community rests with cellular communications. Analog coverage in the community was described as being extremely limited. Some reports suggest that no digital coverage exists (though recent investments by Sprint may have changed this). The current levels of coverage are deemed not to have a positive impact on investment decisions by firms considering relocation to Williams. Furthermore, discussions identify the present cellular coverage situation is a more important issue than broadband service availability for residents and businesses.

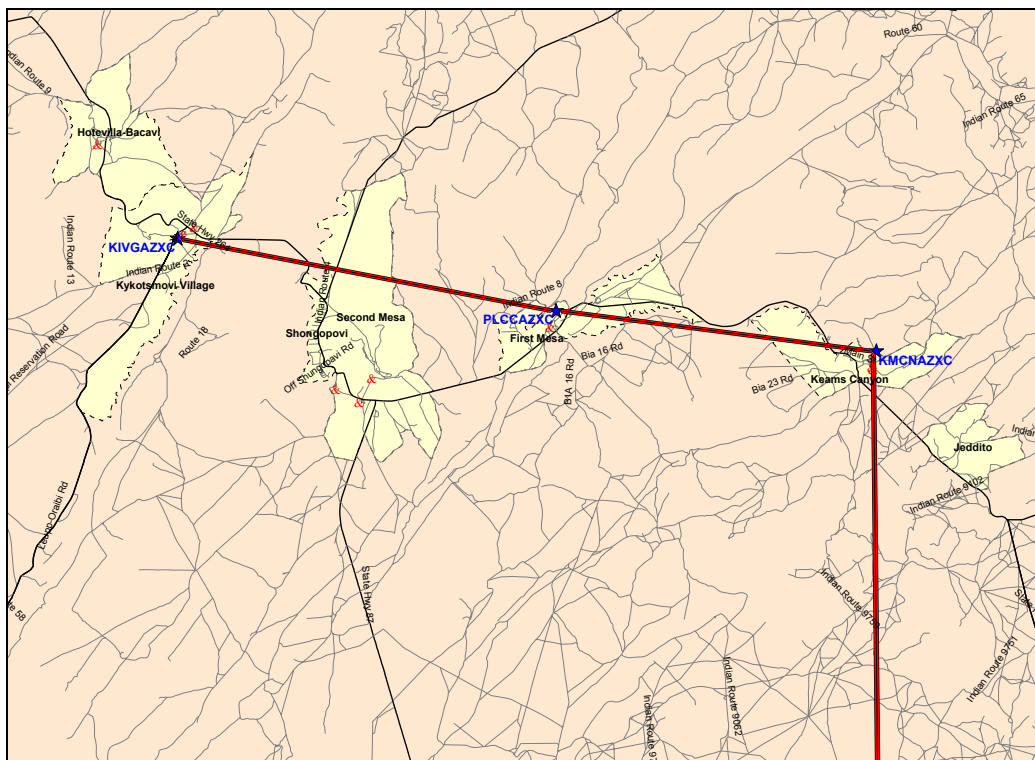
5 HOPI TRIBE

5.1 Capabilities

Hopi Tribe lands are located in northeastern Arizona.¹² It is covered by an extension of the Phoenix LATA Nr. 666. The three exchanges of Kykotsmovi Village, Keams Canyon, and Polacca serve the Hopi Tribe. These exchanges are owned and operated by Century Tel of the Southwest headquartered in Keams Canyon, which in turn is owned by Century Telephone Enterprises with head office in Monroe, LA.

The exchanges contain a total of three wire centers (central offices) as shown in **Exhibit 5.1**.

Exhibit 5.1
Hopi Tribe Telephone Exchanges and Wire Centers



¹² The Hopi Tribe was contacted a number of times over the course of the study, but did not participate in the assessment of needs for undisclosed reasons.

5.1.1 Transport

Transport into the area is provided by a radio system between Winslow and the Keams Canyon wire center. Transport capacity is sufficient for the level of services currently provided, however, it would need to be upgraded to carry additional traffic.

There are no plans to upgrade the transport link into the area. One obstacle to such an upgrade would be the lack of transport capacity on Qwest's section of the network between Winslow and Flagstaff, which will not be expanded in the near future.

While AT&T Longlines operates a fiber optic cable along I-40 which could be used as transport backbone to reach Qwest's fiber facilities in Flagstaff, this cable is only accessible within Arizona in Holbrook and Flagstaff. The AT&T Holbrook center is completely filled and there are no plans to upgrade it.

The Economic Development department of the Tribe is currently investigating other options to augment its connectivity to the telecommunications backbone networks and is considering a radio link to Mt. Elden in Flagstaff. This is a two-hop link and would require the lease of tower space in the Navajo Nation. **Exhibit 5.2** shows existing tower locations within Hopi Tribal lands.

5.1.2 Local Access

The local distribution plant operated by Century Tel of The Southwest, Inc. is copper based.

There does not appear to be a shortage of facilities within the ILEC's operating territory in the Hopi Tribe lands, considering the services currently provided.

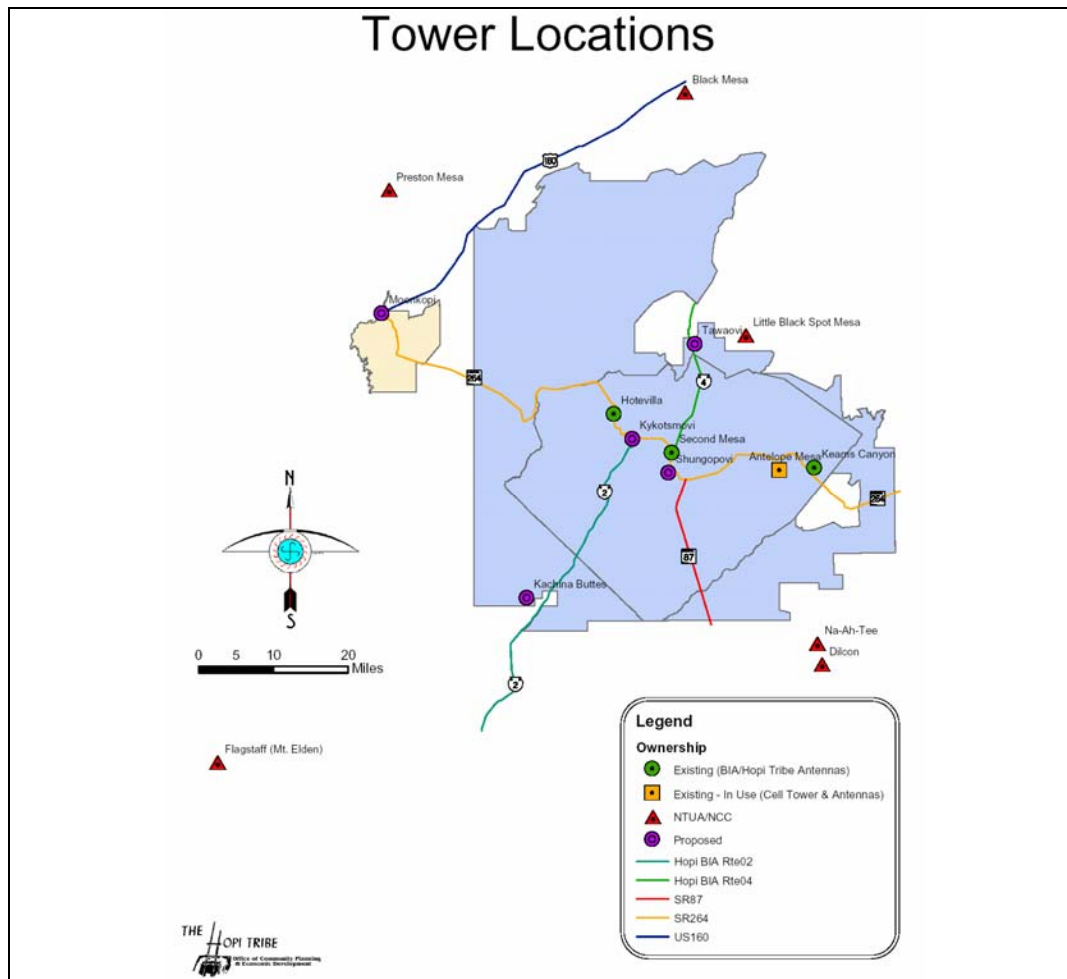
5.1.3 Services

High speed data services up to T-1 level and frame relay services are offered in the exchanges operated by Century Tel of The Southwest, Inc.

Internet access is available using dial-up facilities, with the closest ISP located in Tuba City. Dial-up connections therefore incur long distance charges.

The company is not offering high speed Internet access, and does not have plans to upgrade its transport network, nor to introduce enhanced services such as high speed Internet access with its exchanges serving the Hopi Tribe.

Exhibit 5.2
Telecommunications Tower Locations within the Hopi Tribe Lands



Transport between the exchanges operated by the ILEC is carried on aerial copper cable.

5.1.4 Internet Access Service Pricing

Internet access is via dial-up to Tuba City and/or Flagstaff which incurs long distance charges.

Broadband service is currently not offered.

6 NAVAJO NATION

6.1 Capabilities

The Navajo Nation, excluding those areas located in New Mexico and Utah, is located in the Navajo Nation Arizona LATA Nr. 980.¹³ **Exhibit 6.1** identifies the exchanges serving the Arizona area of the Navajo Nation and located within LATA 980:

Exhibit 6.1
Navajo Nation Exchanges/Wire Center List

WINDOW ROCK	MANY FARMS
BLACK MESA	PINON-COTTONWOOD
CHINLE	RED VALLEY
DILCON	ROUGH ROCK
DENNEHOTSO	ROCK POINT
FORT DEFIANCE	SHONTO
GANADO	TUBA CITY
GREASEWOOD	TEEC-NOS-POS
KAIBETO	TOYEI
KAYENTA	TSAILE
LE CHEE	WIDE RUINS
LUKACHUKAI	

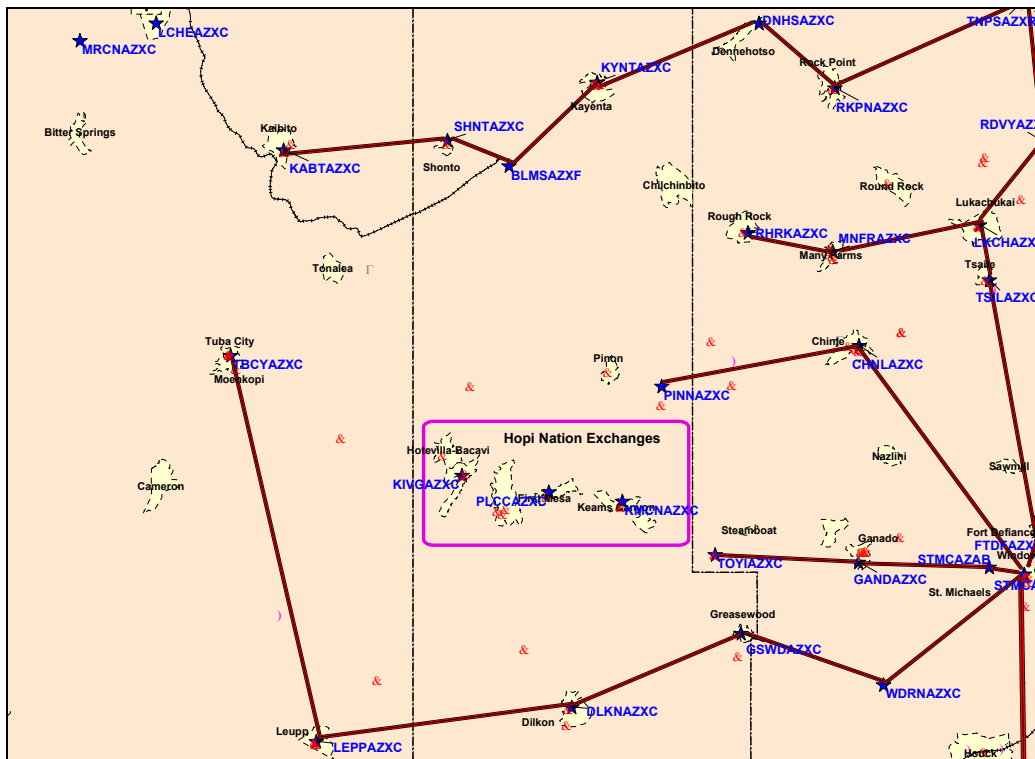
These exchanges are owned and operated by Navajo Communications Company headquartered in St. Michaels, which in turn is owned by Citizen Communications, with head office in Salt Lake City, UT.

The exchanges contain a total of 23 wire centers (central offices) as shown in **Exhibit 6.2**.

As explained earlier in the report, Citizen Communications was unwilling to provide any infrastructure related data for this project. Information was obtained from alternate sources and has been verified to the largest extent possible through other sources. The routing of transport facilities shown in **Exhibit 6.2** is based on information obtained in user interviews and may not be completely accurate.

¹³ The Navajo Nation was contacted a number of times over the course of the study, but did not participate in the assessment of needs for undisclosed reasons.

Exhibit 6.2
Navajo Nation Telephone Exchanges and Wire Centers

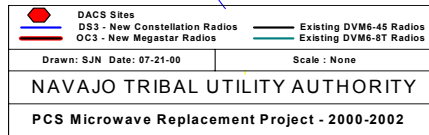


The Navajo Tribal Utility Authority (NTUA) has indicated a desire to augment its telecommunications network to be able to lease capacity throughout Navajo Nation territory. The proposed network upgrade is to link to Qwest's telecommunications backbone at Mount Elden in Flagstaff, as illustrated in **Exhibit 6.3** (NTUA is further described in **Appendix B**).

The expansion plans by NTUA are proceeding slowly in view of a complex and time consuming right-of-way process administered by the Tribal Council, which is expected to take up to four years to complete.

The Tribal Council is in the process of setting up its own regulatory body, overseeing telecommunications in those areas which are within its jurisdiction. This regulatory agency is expected to address the delays inherent in the current right-of-way requirements.

Exhibit 6.3



6.1.1 Transport

Transport into the area is provided by a radio system between Gallup, NM and Window Rock connecting to Navajo Communications Company's wire center in Window Rock. Transport between the exchanges operated by the ILEC is carried either on aerial copper cable or microwave radio.

The transport capacity currently available to the telecommunications backbone is sufficient to accommodate existing service requirements, however, it would need to be upgraded to carry additional capacities required by enhanced services such as large scale roll-out of high speed Internet access into rural areas. Ultimately, transport out of the Navajo Communications Company territory needs to be carried by Qwest's intra-Arizona network along I-40 to Flagstaff. This route is completely exhausted and relief has not been identified in discussions with Qwest.

Another alternative would be to use the fiber optic cable along I-40 operated by AT&T Long Lines to reach Qwest's fiber facilities in Flagstaff. This cable could be accessed in Gallup, NM where AT&T operates a central office.

6.1.2 Local Access

The local distribution plant operated by Navajo Communications is copper based. No dedicated fiber optics runs were identified within the exchanges, and information was not made available by Citizens.

There does not appear to be a shortage of facilities within Navajo's operating territory in the Arizona region of the Navajo Nation lands, considering the services currently provided.

6.1.3 Services

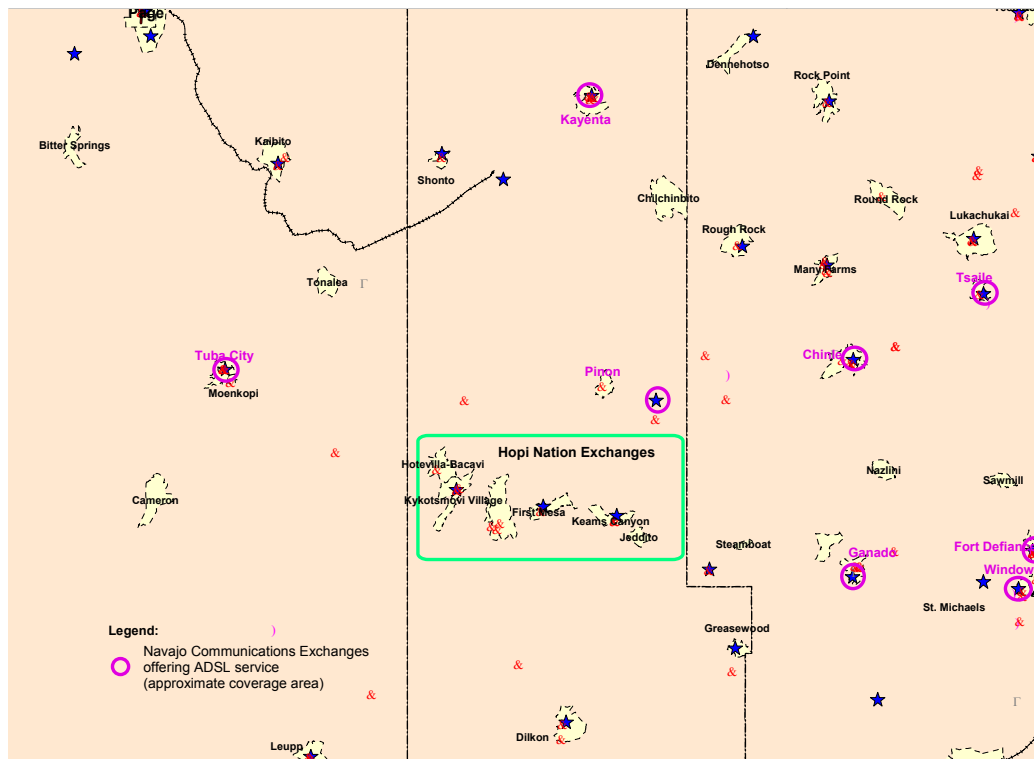
High speed data services up to T-1 level and frame relay services are offered in the exchanges operated by Navajo Communications.

Navajo Communications is offering ADSL service from its wire centers in the following communities within the limitations of 18,000 loop feet:

- | | | |
|-------------------|-----------------|-------------|
| ▪ Window Rock | ▪ Ganado | ▪ Kayenta |
| ▪ Fort Defiance | ▪ Shiprock (NM) | ▪ Tsaile |
| ▪ Navajo | ▪ Chinle | ▪ Tuba City |
| ▪ Tse Bonito (NM) | ▪ Piñon | |

Exhibit 6.4 shows those exchanges operated by Navajo Communications that offer ADSL services, and the approximate coverage area within each exchange.

Exhibit 6.4 High Speed Access Availability



Navajo Cable provides services over a uni-directional network and did not indicate any plans to upgrade its network to enable the sale of cable modem Internet access.

cybertrails is providing Internet access over NTUA's network, however, they are currently not offering wireless access services. IndigeTEC, a technology company, is in the process of erecting communications towers throughout Navajo Nation lands, which would allow for lease of tower space by interested parties, such as wireless ISPs. The first four towers are scheduled to be erected in the area of Chinle, Leupp, Tuba City, and Kayenta.

6.1.4 Internet Access Service Pricing

Navajo Communications' ADSL service is currently offered at \$49.95/month.

Cable modem service is currently not offered.

7 PARKER

7.1 Overview

The Town of Parker is a community with a permanent population of nearly 3,000 located on the eastern bank of the Colorado River in La Paz County.

Exhibit 7.1 provides an overview of local telecommunications service providers.

Exhibit 7.1
Local Telecommunications Service Providers

Basic Telephone Service	Verizon
Cellular Telecommunications Service	Verizon, AT&T, Cellular One
Digital Subscriber Line Service	Not Available
Cable Modem Service	Cablevision of Parker
Wireless Internet Service	None
Broadband Data Services	Verizon

Parker and the Parker Strip are tourism-oriented, with nearly one million short-term vacationers (primarily from California and the Phoenix area) in the summer and long-term vacationers (primarily Canadian “snow birds”) in the winter months. Both these groups bring special connectivity needs, and the level of service available is an influence on their willingness to return to Parker. In particular, visitors from California tend to be wealthy business owners or technology managers, and look to advanced services when they travel and vacation.

The Town views telecommunications as one of a number of critical infrastructures that must be improved to continue attracting business and retaining the population.

7.2 Issues

An “Issues Survey” was delivered to the Town of Parker for distribution. An insufficient number of completed surveys were available at the time this Report was being written. As such, the results of the Issues Survey will be included in the Final Report if additional responses are made available by the Town.

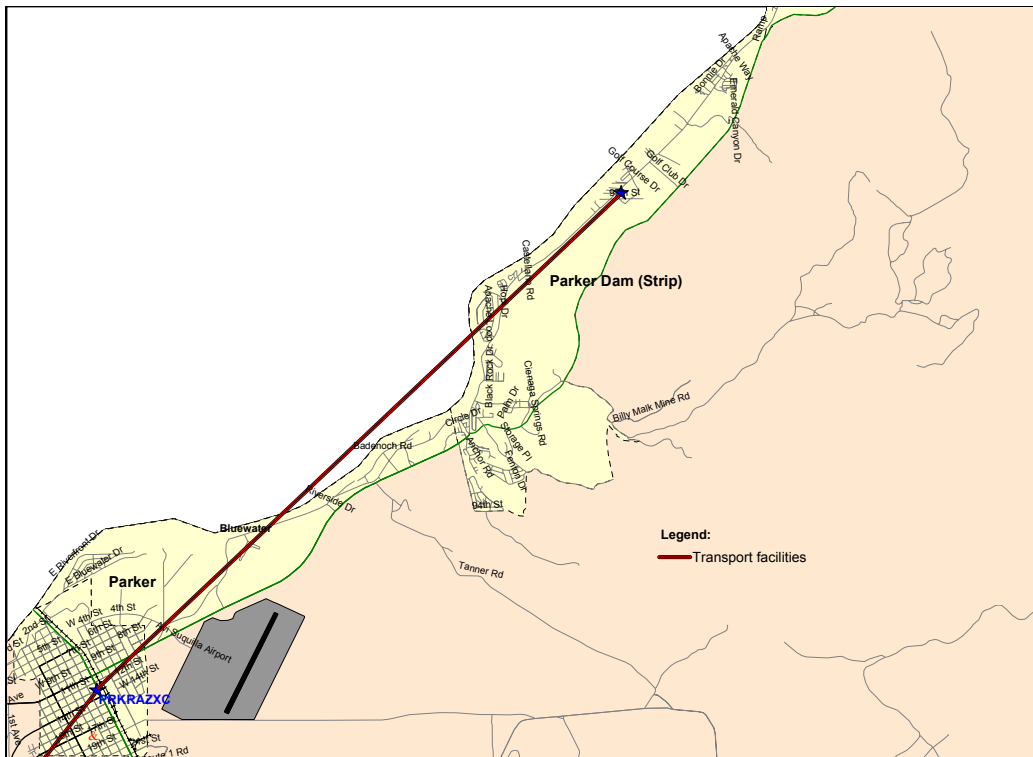
7.3 Capabilities

The communities of Parker and parts of La Paz County are located in the Los Angeles LATA Nr. 730. The area is served by two exchanges:

- Parker Main, covering the community of Parker and surrounding area; and
- Parker Dam covering the recreational area known as the Parker Strip north of the community along the Colorado River.

The exchanges, owned and operated by Verizon California, contain a total of two wire centers (central offices) as shown in **Exhibit 7.2**.

Exhibit 7.2
Parker Exchanges



The location of the Parker exchanges in LATA 730 served by a California based ILEC means that there are no transport facilities connecting directly with the remainder of Arizona but that all traffic is carried via California.

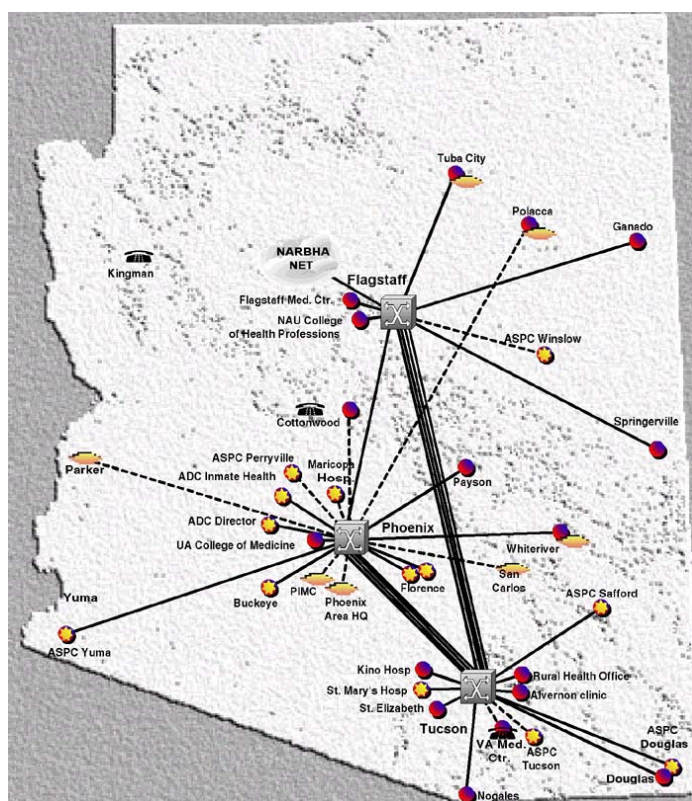
7.3.1 Transport

Transport into the Parker exchange is over a 545 Mbps radio link between Parker and the telecommunications backbone operated by Verizon California at Indio, CA. Transport between the Parker Main and Parker Dam exchanges is via fiber optics cable facilities. Capacity on the radio link is sufficient to accommodate future growth given the current level of services offered.

Verizon California does not have any plans to upgrade or replace the existing radio link. Verizon's facilities into Parker are not backed up by any arrangement for redundancy with other transport providers.

The Arizona Telemedicine Council, concerned about the lack of redundant facilities supporting its network, is considering the implementation of a radio network which would not only use redundant infrastructure but also different routes. **Exhibit 7.3** shows the existing telemedicine network (source: <http://www.telemedicine.arizona.edu/program/sites.html>).

Exhibit 7.3
Telemedicine Network



The proposed plan, affecting Parker, is to build a radio system from Ehrenburg or Quartzsite on I-10 to Parker and on to Kingman. While the planned capacity of the proposed link addresses the demand of the telemedicine network only, discussions are underway to increase the capacity and to modify the Acceptable Use Policy to allow for broadband connectivity into Parker and adjacent communities.

7.3.2 Local Access

The local distribution plant operated by Verizon is primarily copper based. There are no capacity shortages in the local distribution network for services currently offered.

Riverside County, CA is operating a wireless Internet access network connecting its institutions including schools. This network has been extended to include schools in Parker and in La Paz County which are located within LATA 730. The Acceptable Use Policy does not permit the extension of this service to other potential customers within the area.

7.3.3 Services

High speed data services up to the T-1 level are offered in Parker. ATM service is not available.

Verizon is not offering ADSL service from its wire centers in Parker, and there are no plans to introduce ADSL high speed Internet access in the exchange.

Cablevision, headquartered in St. Joseph, MO, is offering cable modem services throughout Parker and Lake Havasu City. Cable modem service is offered extensively throughout the area, spanning primarily from Parker north to the Parker Dam. Very limited coverage exists south of Parker into Colorado River Indian Tribe (CRIT) territory.

There are no Internet service providers which offer wireless access in Parker. The closest wireless access provider, Red River Communications, operates in Lake Havasu City. Red River did not disclose any plans to extend wireless access to Parker Dam or Parker.

7.3.4 Internet Access Service Pricing

Verizon does not offer ADSL service in Parker.

Cable modem service is offered by Cablevision at \$39.95/month for existing cable TV customers.

There is no wireless Internet access provider in Parker, however, wireless service by Red River Communications in nearby Lake Havasu City is offered at \$39.95/month for residential customers and \$89.95/month for business customers at 256Kbps symmetrical speeds. These rates might apply if Red River was to extend their wireless access services to Parker Dam and Parker.

7.4 Needs

Two major needs were identified during consultations with telecommunications users and providers:

- first, the establishment of broader, more reliable cellular telecommunications service; and
- second, the establishment of a competitive broadband service provider to serve Parker, north to Parker dam, and south through CRIT.

In addition, few opportunities for Internet/IT training were identified in the area. An essential component of building awareness and capabilities in the area would involve training programs, possibly extended through the Parker Community Library.

A major challenge for the Town of Parker in the future rests in accommodating future growth. A large area (about 850 acres) to the south-east of Parker has been annexed in anticipation of this growth. No telecommunications (e.g., basic telephone) services are presently available in the area. Discussions relating to service availability and costs have been ongoing with Verizon, but have been proceeding slowly.

7.4.1 Residences

Basic telephone service to residences is reportedly of relatively high quality, with few if any dial tone or customer service issues. Advanced digital telephone services are reportedly not available because of aging switching equipment at Verizon's central office. Unconfirmed and informal discussions suggest that Verizon has tried to divest the area (and that earlier sales discussions with Citizen fell through), and that this may be affecting Verizon's enthusiasm to make capital investments in its local equipment.

Cellular phone service is provided by Cellular One, AT&T, and Verizon. Cellular service is viewed as a major shortcoming in the area, where many “dead” areas exist, and service is often only analog.

The residential sector in Parker has at least three options for local dial-up Internet access. The interviews conducted as part of the consultation process suggest mixed satisfaction over the quality and price of these services. Local dial-up Internet access is not available in all areas of the remainder of La Paz County.

In addition, it is reported that a large percentage (60%) of residents in the Town of Parker and Parker Strip have access to high-speed Internet access via cable offered by Cablevision of Parker. No other broadband technologies are available, such as ADSL or wireless, as competition or to fill gaps in cable modem service coverage. Discussions with community contacts suggest that an alternative service, likely delivered through wireless, would be highly desirable. Wireless service might also best serve the large summer and winter tourist populations, particularly if it were available uniformly across Parker and north along towards Parker dam.

7.4.2 Businesses

The local calling area reportedly presents a problem to many of Parker’s businesses. Much of the areas’s business originates or is directed towards Lake Havasu City. Long distance charges apply to calls from Parker to Lake Havasu City.

Businesses can subscribe to dial-up Internet access, and have several options for securing broadband connectivity. The first is cable modem service through Cablevision of Parker, which reportedly serves a number of smaller businesses. However, cable modem service is not geared to businesses. The second is much more expensive T1 connection through Verizon, though few T1 connections are reportedly in place in the community as a result of the current business needs. T1 connectivity is an expensive option for business base in Parker.

It is doubtful whether a second wired broadband access service could compete in the Town of Parker. As such, a potential option for increasing broadband connectivity into areas presently not served by cable modem service, and for offering additional service packages, rests in a wireless service.

7.4.3 Public Agencies

Discussions were held with a range of public agencies in and around the Town of Parker. For the most part, these agencies were well-satisfied with their existing levels of connectivity.

For example, the Parker Library gets free connectivity via a partial T1. This arrangement has been secured because an ISP is provided space in the basement of the Town Hall in exchange for bandwidth. Seven public access computers are available at the library. However, the operating budget for supporting public access is reportedly stretched. Current staff and budget are viewed as insufficient to offer Internet training to local citizens and businesses. The Library is quite satisfied with the service, with the exception of minor troubleshooting which staff reportedly do not have the capability to easily undertake.

The District has six schools in La Paz County. These are served by a T1 connection providing Internet access through Verizon. Schools are generally connected via 11 Mbps wireless links, with all schools having fiber-based distribution to the classroom. The PUSD is reportedly satisfied with service availability, throughput, uptimes, and rates (including subsidies through E-rate). No new infrastructure is planned, though consideration is being given to upgrading the 11 Mbps radio to 54 Mbps. The Parker Unified School District (PUSD) was generally satisfied with the broadband services it receives, though voiced two concerns.

In the past year, the PUSD had tried to replace its numerous voice lines with a single T1, but was reportedly told that Verizon could not provide them with one. The availability of T1 connectivity thus may be an issue. The PUSD also has considered providing cell phones as the exclusive connection for administrators. However, the existing cellular coverage does not easily allow this.

8 SAFFORD AND AREA

8.1 Overview

Safford, Thatcher, and Pima are communities in Graham County with populations of about 10,000, 5,000, and 2,500 respectively. The area is home to advanced regional education and medical facilities. Agriculture and ranching represent large components of the regional economy.

Exhibit 8.1 provides an overview of local telecommunications service providers.

Exhibit 8.1
Local Telecommunications Service Providers

Basic Telephone Service	Qwest
Cellular Telecommunications Service	Cellular One, Valley Telecom
Digital Subscriber Line Service	None
Cable Modem Service	None (Cable One Soon)
Wireless Internet Service	Eaznet, Zekes, Duncan Valley Electric Cooperative
Broadband Data Services	Qwest

8.2 Issues

An “Issues Survey” was completed for a sample of approximately ten citizens, businesses, and public agencies in the Town of Safford. The results of that survey are shown in **Exhibit 8.2**.

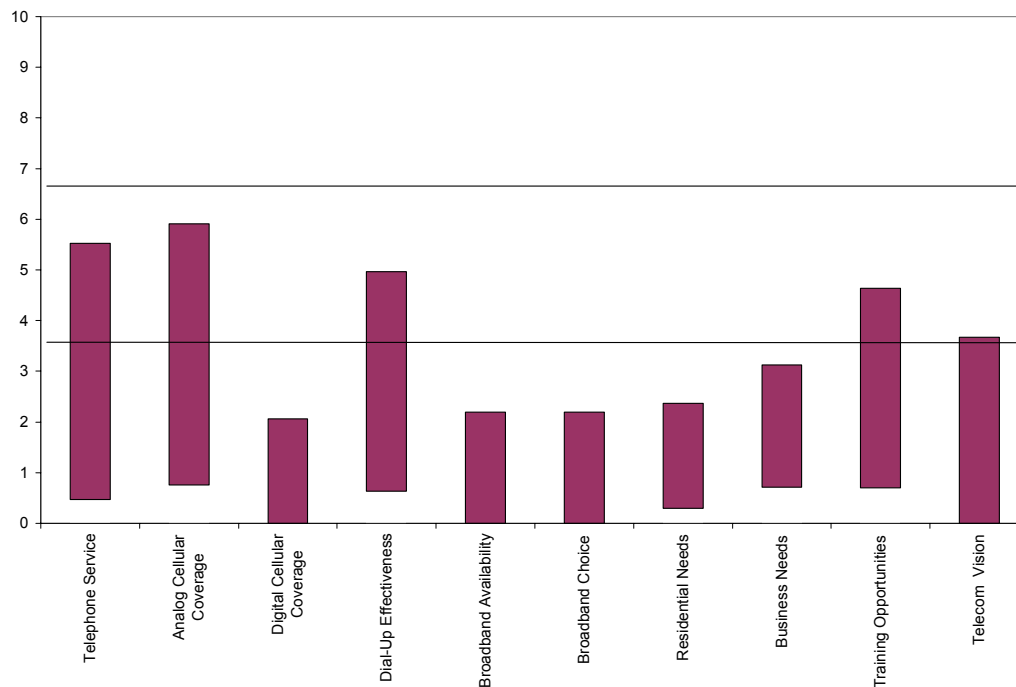
The survey suggests that basic telephone challenges exist, a supposition that is supported by the consultations with citizens and businesses in the area.

Analog cellular coverage is viewed as being generally adequate, with some holes in local coverage. Digital cellular services were viewed as poor.

Survey respondents were not impressed by the extent of broadband coverage, by choice among providers, or by how well residential or business needs are being met.

Little optimism was expressed that training opportunities to help grow the demand side or that a community vision for improving the situation exist.

Exhibit 8.2
Issues Survey Rankings – Safford



Note 1: Survey results show the mean results \pm one standard deviation.

Note 2: The survey results focus on Safford, rather than the surrounding communities.

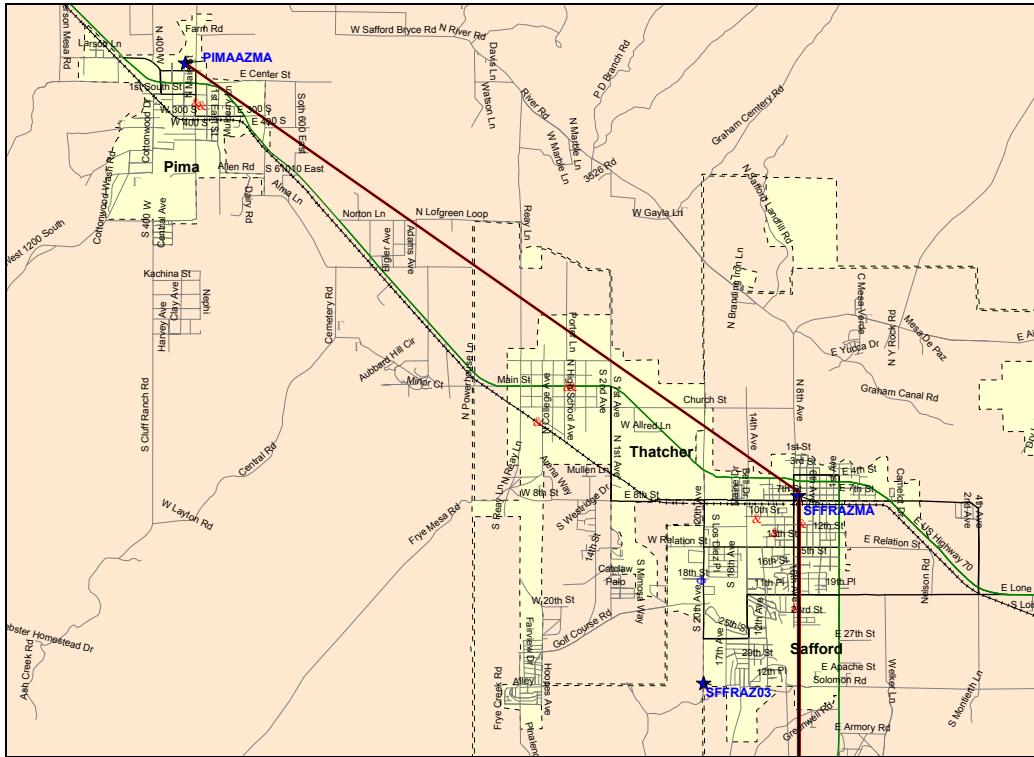
8.3 Capabilities

The communities of Safford, Thatcher and Pima are located in the Tucson LATA Nr. 668. They are served by two exchanges:

- Safford, covering the communities of Safford and Thatcher as well as the surrounding areas; and
- Pima, covering the community of Pima and the surrounding area.

These exchanges are owned and operated by Qwest Communications, and contain a total of three wire centers (central offices) as shown in **Exhibit 8.3**.

Exhibit 8.3 Safford and Pima Exchanges



As described in **Appendix B**, Qwest, after the take-over from US West, attempted to sell its rural exchanges in Arizona, including Safford and Pima. Citizen Communications showed some interest, however, the sale did not materialize.

In the meantime, Qwest did not invest in the upgrade of local nor transport infrastructure in the affected exchanges, leading to the infrastructure bottlenecks and long lead times currently encountered in these exchanges.

8.3.1 Transport

Transport into the Safford exchange is over a 145 Mbps radio link between Safford, Wilcox, and Benson where it connects to Qwest's fiber transport network along I-10. Transport between the Safford and Pima exchanges is over copper facilities.

The radio transport link to the fiber backbone along I-10 is completely exhausted and additional service orders in Safford, Thatcher and Pima requiring connection to the telecommunications backbone facilities usually need to wait for a cancellation of an existing service.

The radio transport facilities were scheduled to be replaced by a fiber optics cable run between I-10 and Safford to expand the transport facilities into the community. This plan is currently on hold for the reasons outlined in **Appendix B**.

This lack of transport facilities adversely affects the timely introduction of enhanced services such as cable modem service on Cable ONE's local cable distribution network. Local Internet access service providers also expressed frustrations over the inability to grow their networks and to introduce high speed access services which require additional transport capacity to the Internet backbone.

In addition, Qwest's facilities are not backed up by any arrangement for redundancy with other transport providers, such as TeleSpectra which operates a radio link from Safford directly into Tucson.

Valley Telecom is currently installing fiber optic cable to Safford. This facility is expected to reach Safford in December 2002. Once completed, sufficient transport capacities is expected to be available as well as providing a redundant transport path.

Alternate transport is provided over a DS-3 radio link to Tucson installed by WinStar. WinStar was subsequently acquired by TeleSpectra (a description of TeleSpectra is provided in **Appendix B**). Community leaders expect TeleSpectra to upgrade this link to OC-3 capacity, however, pricing is an issue since TeleSpectra's prices tend to be higher than those for similar services from the ILECs.

Relief from Qwest though future investments is not expected in the near future as explained in **Appendix B**.

8.3.2 Local Access

The local distribution plant operated by Qwest is primarily copper based. As shown on the detailed map included on the accompanying CD, three dedicated fiber optics cable runs are also installed in Safford.

A situation similar to the transport infrastructure exists regarding the local distribution. Qwest did not invest in the upgrade of the local distribution plant. This plant is now at a point of exhaust and orders for additional telephone services carry long lead times. Due to lack of sufficient copper distribution facilities, Qwest uses subscriber line concentrators in its copper feeder plant to increase local loop capacity. The use of this technology in the local access network limits the ability to provide DSL service.

A preliminary review and analysis of infrastructure data and issues attempted to determine the degree of State leverage to provide relief. Discussions with the Arizona Corporation Commission (ACC) established that the State regulator monitors and enforces the provision of basic services, which cover a single residential telephone line and the first telephone line for a business and that the organization has no jurisdiction to require additional services beyond these basic services on a timely basis.

Valley Telecom is preparing an application to the ACC for permission to offer basic services within the Safford exchange, essentially providing it CLEC status. The company expects this application to be dealt with by mid-2003. If approved, relief within the Safford and Pima exchanges will be obtained. Valley Telecom does not intend to duplicate local copper plant and is looking to MMDS and LMDS applications to provide local access for these services.

Several local entrepreneurs offer wireless access services mostly in point-to-point configurations in the unlicensed 2.4 GHz range to major users in the community. These services are spread throughout the community and are subject to interference problems. Graham County has formed a co-operative group which allocates specific channels within the 12 channel range of 2.4 GHz radio to each provider.

8.3.3 Services

High speed data services up to T1 level are offered in Safford. ATM service is not available.

Qwest is not offering ADSL service from its wire centers in the Safford and Pima exchanges. Introduction of ADSL services is not planned for the Safford and Pima exchanges.

Cable ONE has upgraded its network to be capable of carrying cable modem services, however, has yet to make it commercially available due to transport capacity constraints to the Internet backbone. Service was planned for introduction by September 20, 2002.

Several Internet service providers offer point-to-point wireless access at tiered rates.

8.3.4 Internet Access Service Pricing

Cable ONE's cable modem service will be priced similar to other communities where the company provides high speed Internet access. These rates are as follows:

	Monthly Rate		
	Residential		Commercial
Service:	1/4 T-1	1/2 T-1	Small Office
Download speeds	400 Kbps	800 Kbps	800 Kbps
with basic cable service	\$34.95	\$49.95	99.95
w/o basic cable service	\$44.95	\$59.95	
Modem Rental (optional)	\$5/month	\$5/month	\$5/month

Point-to-point wireless is rated by speed. Typical rates are \$49.95 per month for speeds up to 512 Kbps and \$99.95 per month for speeds up to 1.2 Mbps.

8.4 Needs

By way of an overview, limited options for broadband connectivity exist for residents and businesses. This shortcoming must be overcome in order to help generate local economic and social growth in the area.

Two causes of limited broadband access capabilities are other telecommunications realities. These are the current transport capacity and distribution plant. Existing transport capacity is constrained to the extent that alternative broadband access suppliers have not offered service (e.g., cable modem service). The existing distribution plant is old and generally precludes the extension of at least one broadband service (ADSL), as well as basic telephone service.

8.4.1 Residences

Residents suggest that the basic telephone service is poor, and that problems exist with call quality. Existing plant is reportedly aging and deteriorating, and Qwest has reportedly installed "SLC boxes" to expand basic telephone capacity.

In some areas of Safford, it is reportedly difficult to secure a residential telephone line as a result of limited copper facilities. Anecdotal evidence suggests six month or longer waits for basic telephone service to the home. This is obviously a significant problem when trying to build the local population base, or attract professionals (e.g., doctors, IT specialists, etc.) or new businesses.

A number of dial-up ISPs provide service to residential customers. Dial-up speeds using local facilities is reported to be painfully slow, dampened considerably by the age and condition of copper plant.

No cable modem services were available to serve residents at the time of the consultations, though service is expected to be offered in the near future in Safford, Thatcher, and Pima.

No ADSL services are available, though consultations identified a high degree of interest in future ADSL availability in Safford. There was a general view, though, that uptake would be limited at prevailing prices of \$40-\$50 dollars per month.

In addition, broadband wireless is provided at 256 Kbps by three providers - Eaznet, Zekes, and Duncan Valley Electric Cooperative. For the most part, it is expected that the pricing for these wireless services (over \$50 per month) is more than most residential subscribers would be willing to pay despite the speed benefits relative to dial-up access.

As such, residential subscribers have had little or no choice for securing broadband connectivity. The availability of cable modem service in the near term is thus extremely important.

8.4.2 Businesses

No ADSL or cable modem service is presently available for businesses (though cable modem service may be made available to some smaller businesses if transport capacity permits).

Several wireless providers offer wireless services in the 2.4 GHz unlicensed band in the area. The pricing for the service is in the range of about \$65 per month, which includes bandwidth (256 Kbps) plus mailboxes. A challenge exists in the community because there are 4 users of the unlicensed (2.4 GHz) band. A community spectrum coordination group has been established, and has been working to resolve coordination and interference issues under a "gentleman's agreements" approach.

The challenge of securing T1 connectivity is reported to be a major problem facing businesses in Safford and area. Due to the aforementioned transport capacity problems, orders for new services have long lead times. Anecdotal evidence reports that a number of call centers opted not to locate to the area, primarily because of the unavailability of sufficient long-haul facilities. As a lower priority issue, concerns over customer service were identified, a reality that exacerbates concerns over the availability of broadband connectivity.

8.4.3 Public Agencies

A half dozen public agencies were consulted to understand their perspectives on broadband connectivity. The majority of telecommunications needs of these institutions were reportedly met. Some concerns were voiced over the availability of additional T1s, as well as the availability and quality of basic telephone service.

Eastern Arizona College (EAC) is located in Thatcher, with locations in Globe, Payson, and San Carlos. EAC has a number of T1 channels for Internet access, intra-college traffic, and home user dial-up access spanning Thatcher, Tucson, Globe, Payson, and San Carlos. These channels are provided by Qwest (4 T1s), AT&T (2 T1s), and Qwest/Apache Telecom. cybertrails provides Internet access at EAC's Payson Campus. All voice lines in the Thatcher, Globe, Payson, and San Carlos campuses are provided by Qwest, with long distance handled by AT&T. EAC expressed some concerns over the time lag between ordering and securing T1s in Thatcher, with a waiting period of over one year. Another frustration of EAC in Thatcher rests in the availability and quality of POTS lines.

Northern Arizona University has a campus at Eastern Arizona College in Thatcher, with interactive distance learning, a computer lab, and service offices. The site is linked to Northern Arizona University in Flagstaff. Telecommunications facilities are generally procured through Eastern Arizona College, and no major telecommunications challenges were identified.

The Gila Institute of Technology is also located on Eastern Arizona College in Thatcher, and secures its telephone services through the College. Qwest provides the Institute with a T1 connection, and no concerns over the service or local telecommunications capabilities were voiced.

Thatcher Unified School District has an elementary, middle, and high school. It has three T1 connections, all through Qwest, and Internet access through Eaznet. The School District reports being satisfied with the telecommunications services, and has no capacity constraints. Local telephone service is also through Qwest, with no outstanding concerns.

Pima Unified School District has a K-6 and 7-12 school. The School District is generally satisfied with the voice and data telecommunications services it receives. Phone service is provided by Qwest, and no profound issues have arisen. A 10 megabit wireless network serves its schools, with Cat5 cable or fiber to each classroom. The wireless system is procured through Eaznet, with no significant concerns.

The Mt. Graham Regional Medical Center identified one concern by way of a shortage of T1 connections for its voice traffic. The Center has supplied one solution to "freeing-up" twisted pairs to support basic residential / business telephone service. It recently replaced a Centrex service with a NEC NEAX 2400 PBX, eliminating the need for about 300 copper loops.

The County now leases dark fiber from Cable One, and lights the fiber with its own equipment. All city “agencies” are thus linked, but capacity is unavailable to private enterprise. The County reports no significant unmet needs or other telecommunications challenges of its own.

The County is also providing a wireless solution to local schools. The side-effect of this private network service is the loss of potential anchor tenants revenues for private sector providers, and a possible dampening effect on their operations and expansion plans. In addition, the loss of that anchor tenant revenue means that rates to other providers is higher than it otherwise would be. There is also a view from private sector providers that participation by the County in telecommunications markets influences the decisions of other potential entrants to operate in the area.

8.5 Pima

Pima is served by its own exchange, which is linked to the Safford exchange. All services which are available in Safford are also being offered in Pima. Pima does not have quite the same local distribution constraint which is being experienced in Safford. There are no transport capacity constraints on the link between Safford and Pima.

Cable ONE has upgraded its plant in Pima to be able to offer cable modem service as soon as a transport link to the Internet backbone from Safford has been secured.

8.6 Thatcher

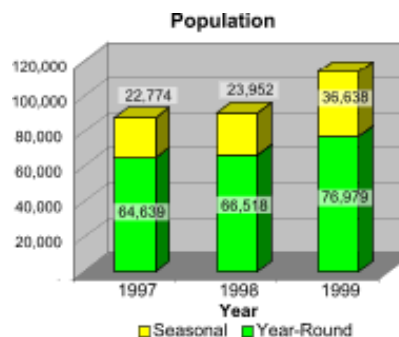
Thatcher is served by the Safford exchange. All services which are available in Safford are also being offered in Thatcher. Thatcher is affected by the same local distribution constraint which is being experienced in Safford.

Cable ONE has upgraded its plant in Thatcher to be able to offer cable modem service as soon as a transport link to the Internet backbone from Safford has been secured.

9 SHOW LOW AND AREA

9.1 Overview

The communities of Show Low, Pinetop-Lakeside, Snowflake, and Taylor are located in Navajo County in eastern Arizona. Show Low has a population of about 7,700, and is the commercial and tourism hub of the “White Mountain” area. Pinetop-Lakeside has a population of about 3,600, Snowflake about 4,500, and Taylor about 3,200. The area has a significant seasonal population which is approaching half of the permanent base.



Source: White Mountain Regional Dev. Corp.

Exhibit 9.1 provides an overview of local telecommunications service providers in the White Mountain area.

Exhibit 9.1
Local Telecommunications Service Providers

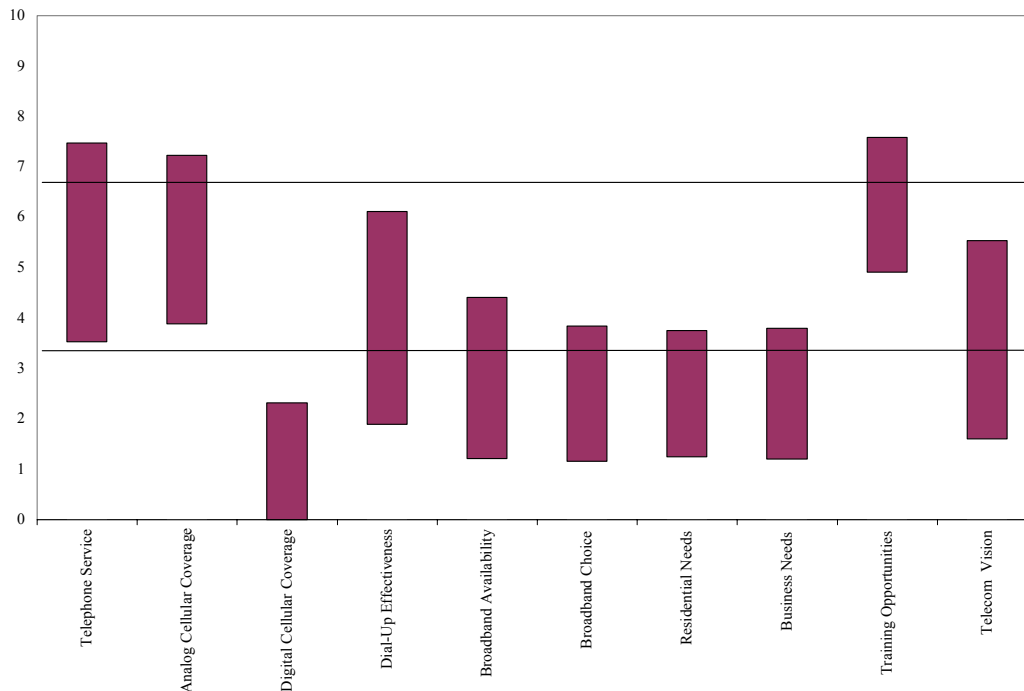
Basic Telephone Service	Frontier
Cellular Telecommunications Service	Cellular One
Digital Subscriber Line Service	Frontier
Cable Modem Service	Cable ONE
Wireless Internet Service	cybertrails, DeweyNet, Global Mountain Communications, NextQuest, White Mountain Online
Broadband Data Services	Frontier

9.2 Issues

An “Issues Survey” was completed by a sample of approximately ten citizens and businesses in Show Low and area. The results of that survey are shown in **Exhibit 9.2**.

Survey respondents generally indicated that basic telephone service, analogue cellular service, and dial-up Internet access were at least adequate (tending to score between 3.3 and 6.7 of 10). Availability of digital cellular services ranked exceptionally low, and training opportunities available through the library system ranked high.

Exhibit 9.2
Issues Survey Rankings – Show Low and Area



Note 1: Survey results show the mean results \pm one standard deviation.

Note 2: The survey results focus on Show Low, rather than the surrounding communities.

The coverage, choice, and effectiveness of broadband services for meeting residential and business needs was usually identified as poor. A general view that broadband needs were not being met existed among informal contacts within the core of Show Low, despite the fact that a number of broadband options currently exist for residential, small business, and large business users. In addition, the majority of businesses and public agencies indicated that their broadband needs were being well-met.

However, some broadband options have only recently been introduced (i.e., ADSL), and others (i.e., cable modem) are being selectively rolled out.¹⁴

¹⁴ It is also recognized that broadband services have not penetrated all areas of the White Mountain equally. For example ADSL services are not available in all communities, and does not have complete coverage of an individual community (i.e., areas in the periphery may not be served).

9.3 Capabilities

The communities of Show Low, Pinetop-Lakeside, Snowflake and Taylor are located in the Tucson LATA Nr. 668. They are served by three exchanges:

- Show Low, covering the community of and area surrounding Show Low;
- Pinetop-Lakeside, covering the community of Pinetop-Lakeside and surrounding area; and
- Snowflake, covering the communities of Snowflake and Taylor, and the surrounding areas.

These exchanges are owned and operated by Frontier Communications, which in turn is owned by Citizen Communications headquartered in Salt Lake City, UT.

The exchanges contain a total of seven wire centers (central offices) as shown in **Exhibits 9.3** and **9.4**.

Exhibit 9.3

Show Low and Pinetop-Lakeside Exchanges

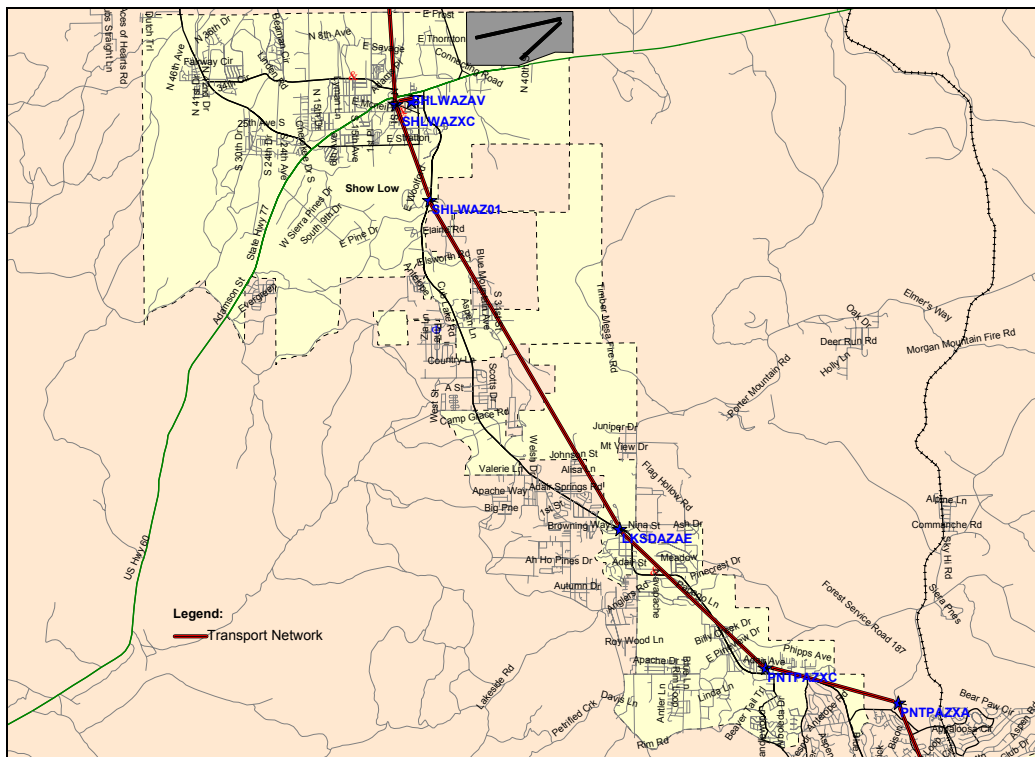
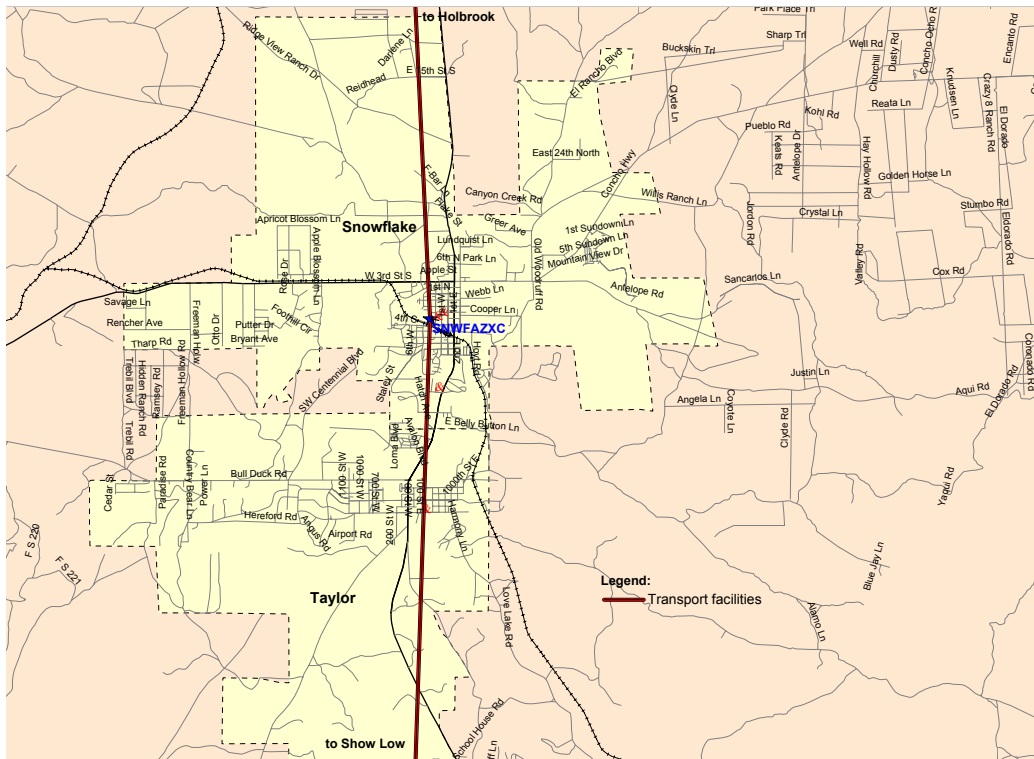


Exhibit 9.4 Snowflake Exchange Serving Snowflake and Taylor



As explained earlier in the report, Citizen Communications was unwilling to provide any infrastructure related data for this project. Information was obtained from alternate sources and has been verified to the largest extent possible though other sources.

9.3.1 Transport

Transport into the area is provided a 465 Mbps radio system between Show Low and Holbrook where it connects to Qwest's transport network along I-40 into Flagstaff. Qwest's transport capacity is exhausted and additional service orders requiring connections to the telecommunications backbone facilities usually need to wait for a cancellation of an existing service.

Qwest had scheduled a replacement of its radio system into Flagstaff with fiber optics transport between Flagstaff and Winslow which would have accommodated any additional transport requirements from Frontier. This plan is currently on hold for the reasons outlined in **Appendix B** and relief is not expected soon.

This lack of transport facilities adversely affects economic development of the region. Local Internet access service providers expressed frustrations with the inability to grow their networks and to introduce high-speed access services that require additional transport capacity to the Internet backbone.

Arizona Public Services (APS) is operating a digital microwave system to its Coronado generating station near St. Johns in Apache County. cybertrails was using part of its capacity but has now secured alternate transport facilities.

Discussions are underway with APS to utilize the freed-up capacity to relieve the transport constraint into the White Mountain region for non-regulated services. To an extent this transport capacity into the Show Low area exchanges would still require an inter-exchange link from Frontier Communications. This approach could prove quite costly since digital channel facilities from Frontier are premium priced.

It theoretically would be possible to utilize AT&T Long Lines fiber optic cable along I-40 to reach Qwest's fiber facilities in Flagstaff. This cable is accessible in Holbrook, however, the AT&T Holbrook center is completely filled and there are no plans to upgrade it. Without a suitable upgrade the additional capacity cannot be provisioned, and alternative options are being investigated.

9.3.2 Local Access

The local distribution plant operated by Frontier Communications is primarily copper based. There are also several dedicated fiber optics runs to large users, however, specific information was not obtained due to Citizens refusal to provide infrastructure related data.

There does not appear to be a shortage of facilities within Frontier's operating territory in the White Mountain region, including the exchanges discussed here.

A small number of wireless service providers are also operating point-to-point facilities mostly in the unlicensed 2.4 GHz range to major users in the communities. These services are spread throughout the area. The introduction of new entrants is essentially managed by controlling access to municipal right-of-way and county owned towers by new wireless entrants.

9.3.3 Services

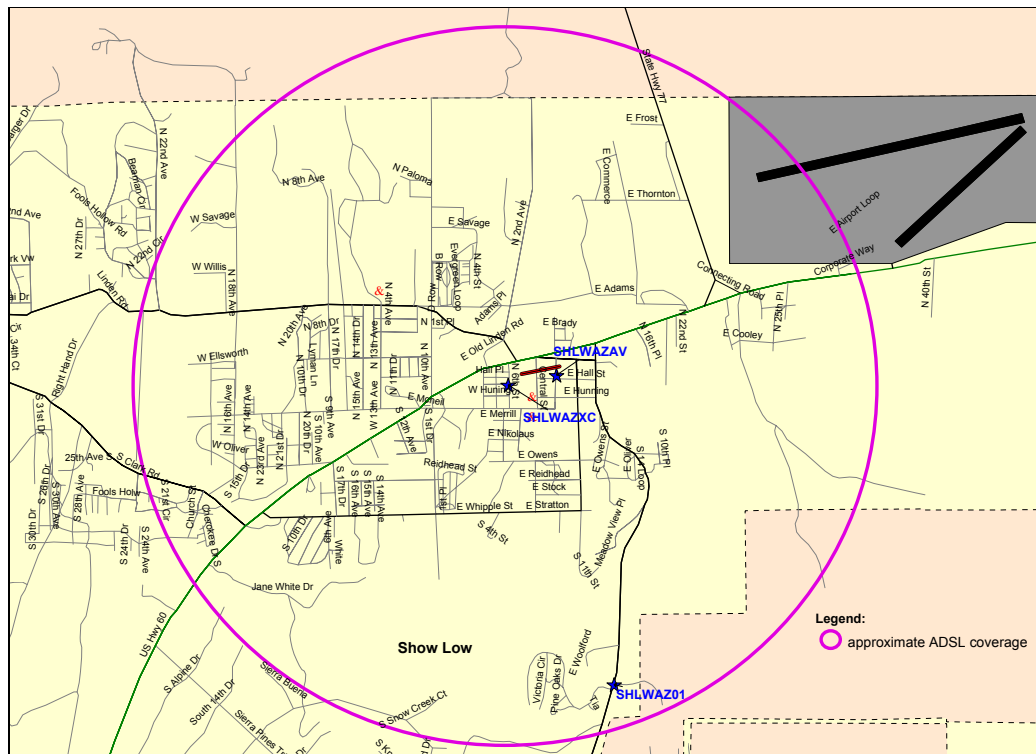
High speed data services up to T-1 level, as well as ATM and frame relay services are offered in the three exchanges. Due to transport capacity problems, orders for these services could have long lead times if connections to the backbone network are required.

Frontier is offering ADSL service from its wire centers of Show Low and Pinetop-Lakeside within the limitations of 18,000 loop feet.

Cable ONE has upgraded its network serving the communities of Show Low, Pinetop-Lakeside, Snowflake, and Taylor to be capable of carrying cable modem services. Rollout of the service is carefully controlled due to the lack of transport capacity to the Internet backbone.

Several Internet service providers offer point-to-point wireless access at tiered rates. The largest of these is cybertrails (see discussions on cybertrails in **Appendix B**) which is using a variety of licensed and unlicensed spectrum as required to minimize interference.

Exhibit 9.4
High Speed Access Availability: ADSL Coverage Area



9.3.4 Internet Access Service Pricing

Frontier's ADSL service is currently offered at \$49.95/month.

Cable ONE's cable modem service is available at the following rates.

	Monthly Rate		
	Residential		Commercial
Service:	1/4 T-1	1/2 T-1	Small Office
Download speeds	400 Kbps	800 Kbps	800 Kbps
with basic cable service	\$34.95	\$49.95	99.95
w/o basic cable service	\$44.95	\$59.95	
Modem Rental (optional)	\$5/month	\$5/month	\$5/month

Point-to-point wireless is rated by speed and average pricing is 256 Kbps at \$60/month with a setup fee of \$850.

9.4 Needs

9.4.1 Residences

A number of dial-up Internet Service Providers operate in Show Low and the surrounding area. These ISPs were generally described as serving their users needs well. However, dial-up Internet access is reportedly very slow – a reality that generated considerable concerns from those interviewed – attributed in part to the incumbent provider's aging plant and switching equipment. Inspections or assessments of this plant and equipment were not undertaken as part of this study.

ADSL broadband connectivity has recently been deployed to serve the residential market in Show Low and Pinetop-Lakeside by Frontier Communications. No such option is available in Snowflake and Taylor. As such, residences have at least one wired broadband option in these communities, where the service can be extended.

In addition, Cable ONE is expected to offer cable modem service in Show Low, Pinetop-Lakeside, Snowflake, and Taylor in the near term. However, the reach of this service into the communities, as a result of transport constraints, is unknown at this time.

Consultations with citizens in the area indicate significant analogue cellular coverage exists, but reportedly no or very limited digital service availability. There was a view that improved digital coverage was important from an economic and social development perspective, and would also contribute to increased uptake of services.

9.4.2 Businesses

Consultations with businesses in the White Mountain area suggest that businesses sometimes have major challenges securing high-speed data and voice services (T1 connectivity). At least part of this problem rests in the unavailability of transport capacity between Show Low and Flagstaff. The major difficulty rests with the length of time required to secure T1 connectivity. A number of businesses indicated that T1 connectivity may take many months to secure.

In addition, these same businesses were of the view that T1 connectivity through Frontier Communications is much more expensive than elsewhere. This view was not confirmed by an assessment of prices in Show Low and elsewhere.

A number of wireless providers also offer broadband services to businesses within the White Mountain area, and the aforementioned DSL service has recently been made available. As such, a number of broadband access alternatives may be available to businesses. These services are generally not available across entire communities, including the core and periphery. However, information on the distribution of service availability was not available from providers.

On the “demand-side”, a number of individuals indicated that many businesses do not understand the merits of broadband connectivity, including the merits of DSL or its availability. Despite the apparent effectiveness of training offered through the library, a program focusing on business applications may have considerable merit in Show Low and area.

9.4.3 Public Agencies

Discussions with White Mountain Regional Development (WMRD) highlighted the importance of broadband coverage in Show Low and area. The agency is very in-touch with the importance of broadband connectivity, and its role in economic and social development. The first question frequently asked to the WMRD by businesses considering locating in the area is “do you have broadband”. Several small- and mid-sized firms have recently located to the area in consideration of the full range of amenities available and particularly broadband services. This reality somewhat contrasts the views of those completing the Issues Survey (see **Exhibit 9.2**).

The Show Low Unified School District (#10) indicated that it is concerned about the ability to secure additional bandwidth in the future as a result of transport constraints. The School District reports having a fiber backbone between several of its facilities, though a single T1 connection links the schools to the outside world. It owns the fiber facilities, but does not lease out excess capacity on the system. The school district previously operated a 2.4 GHz wireless system. This system was contributing to and suffering from the wireless interference in the area, and has been turned off. The School District identified one major unmet need. The Arizona School Facilities Board plans to make centralized learning software (located in Phoenix) available to the schools. The single T1 connection currently available to the school is insufficient to provide access to these materials.

Navapache Regional Medical Center (NRMC) has a 2 Mbps / 512 Kbps Internet connection, a 2 Mbps dedicated link to the Aspen Clinic, a 56 Kbps frame relay connection to Blue Cross, as well as numerous DID and business lines. Discussions with the NRMC indicate that they are generally happy with services, and face no constraints. The Center does not secure rebates through E-rate, however, does get good rates through a long-term contract. The Center had considered upgrading the Internet connection to a T1, however could not get a similarly attractive rate. Of note, the NRMC has pushed to have its doctors secure DSL connectivity from home. All but one of the doctors at the Center reportedly are able to obtain services where they live, providing an indication of the spread of DSL services in the area.

The Show Low Public Library has a computer lab, with a shared T1 connection through cybertrails. The computer lab services over 200 users per week, and tends to be well over 60% full. It has offered basic computer and Internet skills classes, as well as special topic classes (such as for digital camera users). The programs have reportedly had a high uptake and delivered significant value. Overall, the library is quite satisfied with the bandwidth availability and reliability.

9.5 Pinetop-Lakeside

Pinetop-Lakeside is linked with the Show Low exchange and is offering the same services as are offered in Show Low.

Cable ONE is offering cable modem services over its Pinetop-Lakeside cable TV network.

9.6 Snowflake

Snowflake is linked with the Show Low exchange and is offering the same services as are offered in Show Low with the exception of ADSL Internet access. Frontier Communications did not express any plans to extend ADSL coverage to Snowflake.

Cable ONE is offering cable modem services over its Snowflake cable TV network.

9.7 Taylor

Taylor is served by the Snowflake exchange and has the same service capability as Snowflake. Frontier Communications did not express any plans to extend ADSL coverage to the Snowflake exchange serving Taylor.

Cable ONE is offering cable modem services over its Taylor cable TV network.

10 SIERRA VISTA

10.1 Overview

The City of Sierra Vista is located in south central Arizona and has a population of about 40,000. Its population, location, and amenities make it the regional center, with strong economic links to smaller neighboring communities and to Tucson to the north.

Exhibit 10.1 provides an overview of major telecommunications providers in Sierra Vista.

Exhibit 10.1
Overview of Providers

Basic Telephone Service	Qwest
Cellular Telecommunications Service	Valley Telecom Cellular, Cellular One
Digital Subscriber Line Service	Qwest
Cable Modem Service	None (Cox Cable Soon)
Wireless Internet Service	NetBeam, C2i2
Broadband Data Services	Qwest

The City's economy is bolstered by Fort Huachuca's large military and civilian population. The U.S. Army Strategic Communications Command at the Fort endows the City with a wealth of telecommunications savvy through the existence and development of advanced technology and communications businesses.

Notably, the City has taken significant steps forward to develop its telecommunications capabilities through the formation of the Information Technology Task Force. The Task force has held public consultations to identify the area's major telecommunications challenges and identify next steps. Two priority action items identified through the ITTF's draft "Connecting Sierra Vista" paper involve:

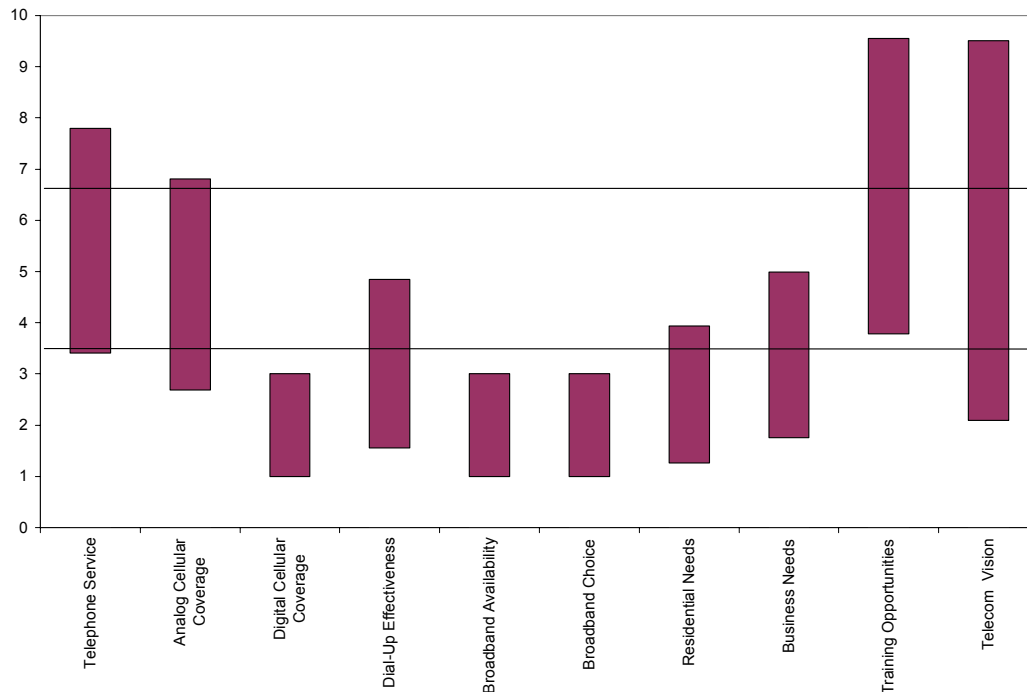
- implementing a statistically-valid survey of telecommunications demand; and
- developing a more clear picture of where telecommunications infrastructure exists.

The Arizona Community Telecommunications Assessment is providing key pieces for both these priority action items. A "demand survey" will be instrumental in furthering both of these items.

10.2 Issues

An “Issues Survey” was completed for a sample of nearly ten citizens, businesses, and public agencies in Sierra. The results of that survey are shown in **Exhibit 10.2**.

Exhibit 10.2
Issues Survey Rankings – Sierra Vista



Note 1: Survey results show the mean results \pm one standard deviation.

Note 2: The survey results focus on Sierra Vista, rather than surrounding communities.

The survey results suggest that basic telephone service in Sierra Vista is viewed as being of high quality. Analog cellular service was also viewed as being at least adequate, though digital coverage was deemed poor.

Survey respondents viewed broadband coverage and choice as inadequate. Business needs were deemed to be met better than residential needs (likely due to the limited options for residential broadband). However, user consultations also identified significant challenges for businesses, particularly in terms of timely T1 connectivity.

The role of Sierra Vista’s Information Technology Task Force was clearly represented in the ranking of the telecommunications vision.

10.3.1 Transport

Transport into the exchange is over copper facilities into the Sierra Vista South exchange and over a 450 Mbps radio system to the Sierra Vista Main exchange, both of which are connected to Qwest's fiber transport network along I-10. The copper link and the radio transport link are completely exhausted and additional service orders in Sierra Vista requiring connection to the telecommunications backbone facilities usually need to wait for a cancellation of an existing service.

The copper transport facilities were scheduled to be replaced by a fiber optics cable run between Palominas and Sierra Vista South to expand the transport facilities into the community. This plan is currently on hold.

This lack of transport capacity adversely affects the opportunity for economic development of the region; for example, it is delaying the timely introduction of enhanced services such as cable modem service on Cox's local cable distribution network. Local Internet access service providers also expressed frustrations with the inability to grow their networks and to introduce high-speed access services that require additional transport capacity to the Internet backbone.

In addition, Qwest's facilities are not backed up by any arrangement for redundancy with other transport providers. Information obtained during the user interviews described how a cut of the fiber optics cable installed along I-10 in 2001 resulted in lengthy outages affecting the exchange.

Valley Telecom is currently installing fiber optic cable through Douglas and eventually on to Sierra Vista. This facility is expected to reach Sierra Vista by June 2003. Once completed, sufficient transport capacities will be available as well the facility could provide a redundant transport path.

Relief from Qwest though future investments is not expected in the near future as explained in **Appendix B**.

10.3.2 Local Access

The local distribution plant operated by Qwest is primarily copper based. As shown on the detailed map included on the accompanying CD, thirteen dedicated fiber optics cable runs are installed in Sierra Vista.

A situation similar to the transport infrastructure exists regarding the local distribution. Qwest did not invest in the upgrade of the local distribution plant other than introducing ADSL at the two switches in Sierra Vista.

The community expects relief through approval of Valley Telecom's application to the ACC, which would allow the company to provide basic services. This application is expected to be filed in December 2002 and a decision made by mid-2003. The company indicates that there is no intent to duplicate local copper infrastructure, and that suitable options such as MMDS and LMDS are being investigated.

A small number of wireless service providers are operating point-to-point facilities in the unlicensed 2.4 GHz range to major users in the community. These services are spread throughout the community.

10.3.3 Services

High-speed data services up to T-1 level, as well as ATM and frame relay services are offered in Sierra Vista.

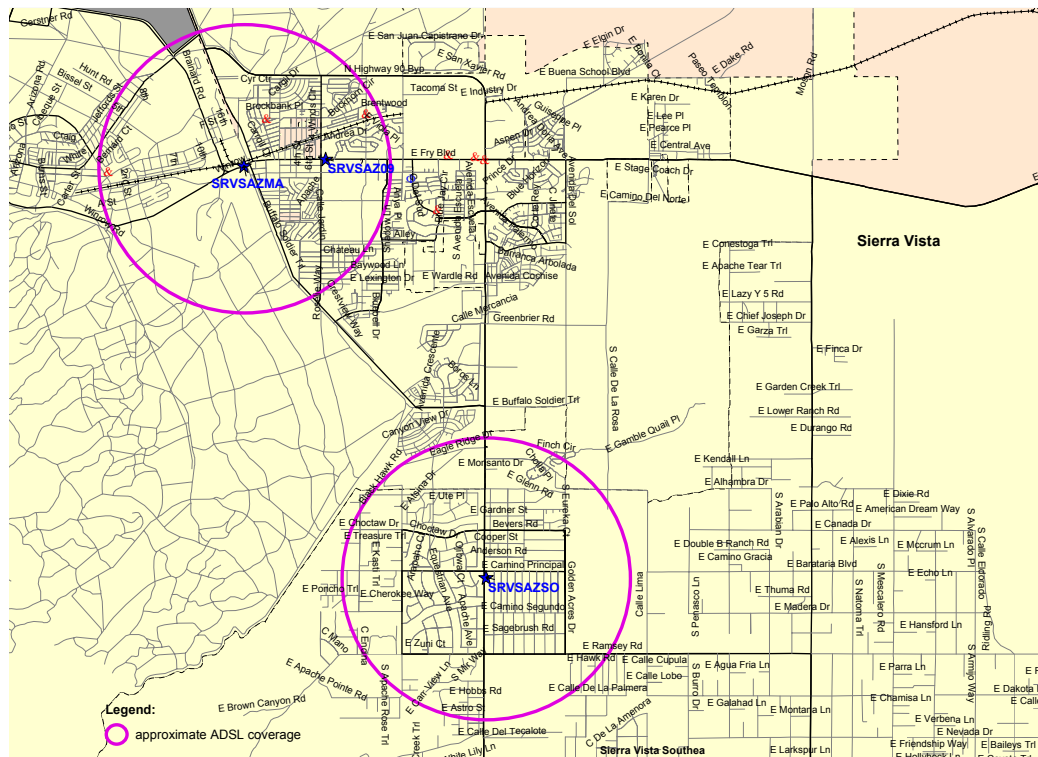
Qwest is offering ADSL service from its wire centers of Sierra Vista Main and Sierra Vista South within the limitations of 18,000 loop feet (see **Exhibit 10.4**).

Cox Cable has upgraded its network to be capable of carrying cable modem services, however, has yet to make it commercially available until suitable transport capacity to the Internet backbone has been secured. It is expected that cable modem service in Sierra Vista will be offered starting January 2003.

Several Internet service providers offer point-to-point wireless access at tiered rates. Sulphur Springs Valley Electric Cooperative (SSVEC) indicated that there was no intent to roll out a local wireless access network, however, recent information indicates that SSVEC has purchased the LMDS license for the Sierra Vista area and is considering service.

Point-to-point wireless is rated by speed and average is 256 Kbps at \$70/month with a setup fee of \$750.

Exhibit 10.4
Sierra Vista ADSL Coverage



10.4 Needs

A single transport link exists from the community to the outside world through Qwest. This was cut in the past, and a redundant link is viewed as a high priority by residents, businesses, and public agencies within the community.

10.4.1 Residences

A fundamental issue exists in regards to plain old telephone service (POTS) in Sierra Vista. There was a view obtaining a dial-tone has been a major challenge in some areas of the City in the past, and this reality has been termed a near-emergency by some. This finding is rationalized by the view that the moderate population base in Sierra Vista is not sufficient to garner Qwest's attention from larger areas such as Tucson and Phoenix, or to justify investments in copper plant and equipment.

The consultations did not identify significant concerns over the availability of cellular telecommunications services.

Residents in Sierra Vista seeking Internet access have a number of options for dial-up Internet access through ISPs. A number of concerns were voiced relating to the quality of dial-up Internet services, where users report having to dial in upwards of ten times to connect and sometimes having frequent service disconnections. Dial-up speeds (utilizing a 56 Kbps modem) were often reported to be in the sub-30 Kbps range.

Digital Subscriber Lines provide a high-speed alternative for those customers living within either of Qwest's DSL provisioning zones in the area. Note that one of these zones is in Sierra Vista proper, and the other covers part of Fort Huachuca. Because the DSL provision zone is in a less affluent area of the City, provider perceptions of potential uptake are diminished. Also note that these zones, representing the maximum range of DSL connectivity, cover only a portion of Sierra Vista. As such, a relatively large portion of local residents and businesses are not expected to have access to this service.

Cox Communications provides cable television service throughout Sierra Vista and has upgraded its plant to be to carry cable modem services. However, this service is not being rolled out as a result of transport constraints, and is not available to residents.

As such, many of the residents in Sierra Vista have not options for securing wired broadband connectivity. This finding is unusual, given the relatively large size of the community and its potential customer base.

Some broadband wireless services are reportedly available, for example through NetBeam and C2i2, though information could not be obtained through the consultations on the character, pricing, or penetration of these services.

10.4.2 Businesses

A relatively large number of technology-intensive businesses are springing from the expertise developed through Fort Huachuca's Strategic Communications Command. These businesses require high-speed connectivity with a high quality of service, yet find that this is not always available as a result of both local access and transport challenges.

Short of fractional T1 channels, small businesses can often access no more than dial-up. Cable modem service is not yet offered, and is often not available to businesses. DSL is unavailable in much of the City. And, wireless services are reportedly more costly and less proven.

These realities adversely affect the attraction of new businesses and growth of existing businesses. Some members of Sierra Vista's economic and community development organizations say that growth is primarily constrained by the availability of broadband connectivity and not by other factors like real estate, builders, or skilled labor.

The manufacturing sector in Sierra Vista is somewhat constrained by availability of water. So, technology and service sector businesses are a target priority. Yet, these businesses cannot easily be targeted because of delays over getting broadband (T1 and fractional T1) to these businesses, reportedly because of transport capacity shortages. A number of IT-centric businesses have opted not to locate in Sierra Vista primarily because of concerns over the availability of high-speed connectivity (e.g., T1 channels).

It is expected that the major concern here is the installation times for new or relocated services. A number of sources identified that businesses in both older and newer areas of the City waited several months or longer for installation. This delay is viewed as a major challenge that Sierra Vista must overcome in order to have its businesses better served from a telecommunications perspective. There is a growing concern that the universe of technology companies increasing knows of these challenges, and as a result won't consider the City as a potential place of business.

Finally, a concern was expressed that rates for high-speed connectivity are considerably higher than in nearby Tucson, placing Sierra Vista at a competitive disadvantage. Relative rates in the State have not been assessed under this project.

In summary, businesses in Sierra Vista have limited options for broadband connectivity. This is particularly the case for smaller businesses which have no need for T1 connectivity.

10.4.3 Public Agencies

Public agencies in Sierra Vista were generally pleased with the telecommunications services from their providers. For example, Sierra Vista Public Schools (SVPS) has been very pleased with the telecommunications service from Qwest, and has generally been satisfied with the level of customer service, speed of response, and pricing (note that the SVPS gets T1 channels at a significant cost savings through E-Rate).

The major exception to this observation involves reports over the timing of high-speed (T1) installations and moves. As a secondary issue, pricing is becoming an issue with some agencies.

For example, the Sierra Vista Regional Hospital has opened several new facilities. To move existing T1 capabilities into one location reportedly took 3 months, and to a second location took 9 months. This, and price considerations, are driving the hospital to consider establishing their own wireless network.

Cochise College also faced challenges ordering a new T1 channel. An order was placed six months before a new facility was to open. It was reported that the order was lost by the provider, though it did ultimately get the channel in place before opening at great prodding from the College. A second problem rests in the availability of regional connectivity. The College will be offering fully interactive classes at its Sierra Vista, Douglas, and Benson campuses (fed through Sierra Vista). But, the unavailability of timely T1 connectivity is precluding the extension of that service to its Wilcox campus.

The City recently built a new maintenance facility, and could not quickly or cost-effectively get T1 connectivity from Qwest. So, the City established a microwave link to the facility, which has generated significant cost savings.

The University of Arizona is generally pleased with services, but may have to cut back the use of services because of costs and mounting budget pressures. This would remove, in all probability, a T1 channel between Sierra Vista and Douglas. Also, in offering distance learning, the real bottleneck is the residential connection issue; i.e., the lack of high-speed Internet services needed for students to effectively access the courses (which limits the distance learning services that can be offered).

11 CONCLUSIONS

The process of consulting with telecommunications users and service providers to prepare an inventory of the telecommunications infrastructure and services, and the assessment of user needs, has identified a number of “barriers” limiting the expansion of the telecommunications capabilities of the communities under study. The most significant of these barriers, those that are imposing the worst impact on the communities are identified in this section.

The scope of the study was focused on determining user needs and did not encompass a subsequent activity to assess and dimension alternatives to effectively address these barriers. However, the results of the consultations suggest a number of actions that the communities may wish to consider.

The most significant barriers limiting the expansion of telecommunications capability identified in the study area include:

- limited capacity on inter-city transport facilities;
- limited capacity and capabilities of some local access networks;
- limited coverage of high-speed Internet service;
- poor cellular telephone coverage; and
- missing redundant inter-city transport.

Limited Capacity on Inter-city Transport Facilities

Limitations of available capacity on inter-city transport facilities to a number of communities can either limit the volume of broadband services within a community, or even block the provision of such services entirely. In some cases, capacity on the transport facility is so tight that individual orders for broadband services, usually T1s, cannot be filled until there is a cancellation and removal of a circuit that frees up adequate bandwidth. This limited capacity on transport facilities also frustrates the efforts of service providers to offer high-speed Internet services in the affected communities in that the additional traffic from these services cannot be accommodated on the transport facilities. Communities identified with severe limitations of transport capacity include:

- Safford and area;
- Show Low and area;
- Sierra Vista;
- Page; and
- Williams.

Rectifying this situation could prove to be a challenge. Corrective measures range from the addition and upgrade of equipment on fiber optic and digital radio facilities to a replacement of some copper links with either fiber optic or digital radio technology. The carriers are strapped for capital and it will take the identification of a compelling business case to budget their capital programs sufficiently to address the capacity issues in these areas.

There are plans for other service providers to provide transport connectivity to certain communities (refer to the individual community write-ups). These plans are crucial to future telecommunications development in the communities, and the communities should monitor progress in securing this new infrastructure, and provide support in any manner possible. The communities should also make these transport capacity challenges known to the State Government, including the Department of Commerce (for consideration in future telecommunications assessments) and the Arizona Corporation Commission.

Limited Capacity and Capabilities of Some Local Access Networks

The local access networks serving some communities are at capacity limits, even to the point of held orders for local telephone service or data connections. Certain local networks are reported as being in a state of poor repair with the consequence of not being able to support quality data services, including reliable dial-up Internet connections. Communities identified with local access network capacity issues include:

- Safford;
- Thatcher; and
- Sierra Vista.

The solution to this reported issue would require additional feeder and distribution plant (copper and/or fiber optics cable), refurbishing of existing loop plant, and possibly upgrading the local switch. This is not a short-term solution, particularly given the current financial state of the major carriers. However, from the perspective of providing high-speed Internet connectivity, one approach to consider is the “encouragement” of wireless ISP service. One approach to consider is an arrangement with wireless ISPs to enter or expand services in the affected areas with assistance from the community and possibly external grants.

Note that resolving the local access network shortcomings in itself for the communities listed above is not sufficient to resolve the bottleneck limiting additional services and service volumes. Although additional capacity and capability to support broadband services would be made available in the local access network, there would still be a bottleneck to additional traffic to and from the communities unless the transport capacity shortage issue is rectified.

Limited Coverage of High-speed Internet Services

Although many of the communities in the study are served by one or more Internet ISPs providing high-speed Internet services, there are areas of all communities that are not in the coverage “foot print” of these ISPs. These areas may be beyond the reach of DSL service, or not served by either a cable operator or a wireless ISP. Determining an accurate picture of the actual footprint of effective high-speed Internet service availability would require detailed data from the local service providers and whom themselves may not have an accurate picture of effective coverage. In many service areas, particularly those with older copper distribution networks, or networks that have not been kept in a good state of repair, the service provider must actually verify individual copper loops to determine if they can support DSL service. Regardless, input from the local service providers is necessary to refine the footprint picture.

Estimates of DSL coverage within communities for the purposes of this study were determined using an established industry methodology that assumes that DSL service can be provided within a radius of 18,000 feet from a DSL equipped telephone company wire center. In reality, the nominal effective distance is 18,000 feet of copper loop wire and within a radius of 18,000 feet from a wire center there will be loops that exceed this distance. Detailed data is required to refine the coverage estimates. Evidence clearly shows that there are indeed areas within communities where DSL service is not available.

Regarding cable television companies, the relevant factors determining the footprint for high-speed Internet are the actual coverage of the cable operators’ networks (homes passed) and the state of the coaxial cable network; i.e., equipped for two-way transmission. Data on the actual coverage of the cable operators’ networks was not provided. Estimates of the coverage footprints were obtained from the cable operators verbally.

As a next step in determining a more accurate assessment of the actual effective availability of high-speed Internet and other broadband services, there are two suggested approaches. The first is to undertake a follow-on study backed with more pressure from the government and perhaps the ACC on the service providers to supply the data necessary to determine the coverage footprints. The second approach is to conduct focused surveys to determine estimates of coverage directly from the existing and potential end-users of the services.

Poor Cellular Coverage

Feedback from certain communities (Parker and Williams) identified improved coverage of cellular telephone service as more important than the availability of broadband services. It is assumed that the cellular service providers are aware of the coverage limitation in these communities and that there in their view the business cases to expand analog coverage or to provide digital coverage will not support the needed investments.

In situations where a community sees a need for services and the service provider does not see an acceptable business case to act, a strategy the community could consider is to focus on demonstrating to the service provider that there is demand that exceeds the service provider's assumptions. This strategy is discussed in more detail below.

Missing Redundant Inter-city Transport

The absence of a redundant transport network was identified as a common issue for the communities covered in the study. This issue was viewed as one that directly negatively impacts economic development in these communities in that several of the communities have evidence of companies eliminating their communities as suitable locations for their business. Flagstaff is of particular note, as it is a hub for transport links to many communities in Northern Arizona. A failure on the single fiber optic route from Phoenix to Flagstaff has resulted in lengthy service outages in Flagstaff and all communities whose transport links hub at Flagstaff. This situation presents a risk that companies that depend on telecommunications for the success of their business are not willing to take.

Sierra Vista is another prime example where a missing redundant transport route is a considerable concern to its technology-savvy business base.

The communities may wish to voice concerns to the State Government over the single transport link. As one outcome, the State Government may wish to procure a detailed assessment of: [i] the need for redundant transport routes across Arizona; [ii] technology options and costs for establishing those routes; and [iii] corresponding State and Federal regulatory considerations. This is a topic that should be addressed to an extent in the Department of Commerce's Broadband Technology Study.

A common theme expressed by the communities is that there is a strong demand for telecommunication services and that this demand is not being met by the existing service providers, particularly the Local Exchange Carriers. Strategies that address supply-side issues through external actions such as invoking support from the governments and regulatory agencies can be expected to be extremely time consuming and have a limited probability of success. Strategies that focus on demand-side issues may stand a better chance of influencing positive action from the service providers. The challenge is to demonstrate to the service providers that the demand for their services exceeds their current estimates. Strategies that both provide more accurate measurements of current demand and also include action plans to increase demand will be most effective.

This topic goes well beyond the scope of this current study, however a closing example is provided for discussion. It has been identified that more and better information is needed to build realistic coverage footprints of broadband services in the communities and that obtaining the needed data from the service providers will be a challenge. An alternative route for securing this information would be through implementation of the demand surveys.

The availability of such information would put the communities in a better position in future negotiations for expansions of coverage. It could also be used as a tool for assisting residents and businesses moving to the area. Finally, it might be used by the communities to promote uptake in areas where service already exists, thereby increasing the profitability of service providers' past investments and potentially leveraging goodwill towards future investments. However, evidence shows that some communities do not have the "champions" or resources needed to drive the implementation of those surveys. In this respect, additional financial and technical assistance from the State may be required.

APPENDIX A

PROVIDER AND USER CONSULTATIONS

Community	Infrastructure and Services	User Needs
Flagstaff	<ul style="list-style-type: none"> ▪ Jereon Moetwil, Infomagic ▪ John Lindsay, RediLynx (Niles Radio) ▪ Jim Browning, President, TeleSpectra, LLC ▪ Leslie Wilder, AT&T ▪ Kevin McCarthy, AT&T ▪ David Ayers, BNSF Railway Co. ▪ Wayne Belkman, Cablevision ▪ Mark Davies, CommSpeed ▪ Kevin Hoagland, CommSpeed ▪ Richard Moore, cybertrails ▪ Deborah Klein, cybertrails ▪ Gary Nieboer, Electric Lightwave, Inc. ▪ Joel Goldberger, InfoMagic ▪ Larry Fitchett, Niles Radio ▪ Jeff Szabo, OmniNet ▪ Al Macaluso, Qwest ▪ Kim Marona, Qwest ▪ Kevin McNeil. Arizona Telemedicine Network ▪ Tom, TekData ▪ Steve Orten, The River 	<ul style="list-style-type: none"> ▪ Jeri Dustir, Deputy City Manager, Flagstaff ▪ Stephanie McKinney, Greater Flagstaff Economic Council ▪ Vernon Reed, Greater Flagstaff Economic Council ▪ Joe Sotomayor, IS Manager, City of Flagstaff ▪ David Wessel, Flagstaff Metropolitan Planning Organization, City of Flagstaff ▪ Don Baker, Mike Brehn, Flagstaff Library ▪ Fred Estrella, Paul Neuman, Matt McGlamery, Northern Arizona University ▪ Jim Hoey, Flagstaff Unified School District ▪ Kevin Adam, League of Arizona Cities and Towns ▪ Tom Belshe, JJ Allan, GADA, ADOC ▪ Bob Tippet, Business Development Northern Arizona, ADOC ▪ Chuck Bowers, U.S. Geological Survey ▪ George Holland, IS Director, Coconino County ▪ Frank Pollard, Table Mountain Trading ▪ Beth Collins, Machine Solutions ▪ Richard Campbell, W.L. Gore ▪ Jeff Saville, Direct Impressions
Page	<ul style="list-style-type: none"> ▪ Randall Medicine Bear, Navajo Tribal Utility Authority ▪ Chuck Dunlop, Cable ONE ▪ Lyle, Cable ONE ▪ Mark Davies, CommSpeed ▪ Kevin Hoagland, CommSpeed ▪ Richard Moore, cybertrails ▪ Tom, TekData ▪ Jeff Szabo, OmniNet ▪ Al Macaluso, Qwest ▪ Kim Marona, Qwest ▪ Ray Napoletano, Mountain Telecommunications ▪ Kevin McNeil. Arizona Telemedicine Network 	<ul style="list-style-type: none"> ▪ Mike Bergner, IT Managers, City of Page ▪ Bob Margerison, IT Technician, City of Page ▪ Gracie Burton, Economic Development Coordinator, Page

Community	Infrastructure and Services	User Needs
Williams	<ul style="list-style-type: none"> ▪ Leslie Wilder, AT&T ▪ Kevin McCarthy, AT&T ▪ David Ayers, BNSF Railway Co. ▪ Mark Davies, CommSpeed ▪ Kevin Hoagland, CommSpeed ▪ Larry Fitchett, Niles Radio ▪ Al Macaluso, Qwest ▪ Kim Marona, Qwest ▪ Kevin McNeil, Arizona Telemedicine Network 	<ul style="list-style-type: none"> ▪ Dennis Wells, Manager, Town of Williams ▪ Joe Duffy, Asst. Manager, Town of Williams
Hopi Tribe	<ul style="list-style-type: none"> ▪ Louise Garland, Century Telephone of the Southwest ▪ Myron Honyaktewa, The Hopi Tribe ▪ Kevin McNeil, Arizona Telemedicine Network 	<ul style="list-style-type: none"> ▪ The Hopi Tribe did not participate in the user needs consultations
Navajo Nation	<ul style="list-style-type: none"> ▪ Tony Davis, Navajo Area Indian Health Service ▪ Kevin McNeil, Arizona Telemedicine Network ▪ Teresa Hopkins, Indige TEC ▪ Randall Medicine Bear, Navajo Tribal Utility Authority ▪ Luke Deswood, Navajo Nation, General Services Division ▪ Ken Peterson, Navajo Nation, Program Director ▪ Victoria Taliman, Navajo Communications ▪ Curt Hutsell, Citizen Communications ▪ Randy, Navajo Cable Company ▪ Denise Copeland, Navajo Nation, IT 	<ul style="list-style-type: none"> ▪ The Navajo Nation did not participate in the user needs consultations
Parker	<ul style="list-style-type: none"> ▪ Danny, Parker Cablevision ▪ Lisa, Red River Communications ▪ David Keough, SRP ▪ Jim Shipley, Verizon ▪ Kevin McNeil, Arizona Telemedicine Network 	<ul style="list-style-type: none"> ▪ Lanny Sloan, Town Manager, Town of Parker ▪ D.L. Wilson, Arizona Public Service and member of Parker Town Council ▪ Cliff Edy, La Paz County Board of Supervisors ▪ Darin Cribbs, IT Director, City of Parker ▪ Don Rolapp, Director of Tourism, Town of Parker ▪ Christian Castro, Parker Unified School District ▪ Jana Ponce, Director, Parker Community Library ▪ Amelia Flores, Colorado River Indian Tribes Library

Community	Infrastructure and Services	User Needs
		<ul style="list-style-type: none"> Neil Flores, Colorado River Indian Tribes Judicial Court System
Safford	<ul style="list-style-type: none"> Al Macaluso, Qwest Kim Marona, Qwest Steve Lunt, Duncan Valley Electric Cooperative Richard Dullum, Valley Telecom Jim Simms, WinStar, TeleSpectra Jim Browning, TeleSpectra John Zeke, Zeke's Internet Chuck Dunlop, Cable ONE Ed Frye, EazNet Kevin McNeil, Arizona Telemedicine Network David Jones, Diamond Computers (gilavalley.com) Richard Boyles, Arizona Corporation Commission 	<ul style="list-style-type: none"> Sheldon Miller, President, Graham Chamber of Commerce John Lucas, IT Director, Graham County George Sticklin, Mt. Graham Regional Medical Center Max Phillips, Northern Arizona University (Safford) Stan Smith, Superintendent, Pima School District Bill Sharp, Thatcher Unified School District Thomas Thompson, Eastern Arizona College Dean Phillips, Gila Institute of Technology Glen Dowdel, Safford City – Graham County Library Chuck Hoisington, Open Loop Energy Vaughn Grant, Country Companies Insurance Group William Sherlock, Collins Precision Manufacturing, Inc. Cord Clonts, Impressive Labels, Inc.
Show Low	<ul style="list-style-type: none"> Curt Huttzell, Citizen Communications Chuck Dunlop, Cable ONE Lyle, Cable ONE Richard Moore, cybertrails Deborah Klein, cybertrails Wally DeWitt, DeweyNet Dianne Pearson, Frontier Communications Steve Curl, Logic Center Byron Clark, NextQuest Kevin McNeil, Arizona Telemedicine Network Jack Wood, White Mountain Online Jim Browning, TeleSpectra Al Macaluso, Qwest Leslie Wilder, AT&T Kevin McCarthy, AT&T Ray Napoletano, Mountain Telecommunications Greg Gadek, Mountain 	<ul style="list-style-type: none"> Patrick Dorner, City of Show Low Shirley Pulsipher, Network Administrator, Apache County Al Scott, Technology Director, Unified School District Bob Moffett, White Mountain Regional Development Kent McQuilan, CIO, Navapache Reg. Medical Center Don Fogle, Show Low Public Library

Community	Infrastructure and Services	User Needs
	Telecommunications	
Sierra Vista	<ul style="list-style-type: none"> ▪ Al Macaluso, Qwest ▪ Kim Marona, Qwest ▪ Bard Waldo, C2i2 ▪ Howard Staff, Cox Communications, Inc. ▪ Richard Moore, cybertrails ▪ Deborah Klein, cybertrails ▪ David Bane, Sulphur Valley Electric ▪ Richard Dullum, Valley Telecommunications ▪ Kevin McNeil, Arizona Telemedicine Network 	<ul style="list-style-type: none"> ▪ Casey Jones, Sierra Vista Mayor Pro Tem ▪ John Cassella, Assistant to the City Manager ▪ Jim Holmes, Sierra Vista Hospital ▪ Neil Garra, President, S2 Company ▪ Dr. Phil Callahan, Professor, University of Arizona ▪ Marie Wurth, Past President, Chamber of Commerce ▪ Barry Albrecht, Exec. Dir., Economic Development Fdn. ▪ Fred Martin, IT Manager, Sierra Vista Public Schools ▪ Carlos Cartangena, VP of IT, Cochise College ▪ David Gunckel, Director, Sierra Vista Public Library ▪ Brad Roush, IT Director, City of Sierra Vista

APPENDIX B

PROVIDER INFORMATION

B. TELECOMMUNICATIONS SERVICE PROVIDERS AND INFRASTRUCTURE OWNERS AND OPERATORS

B.1 Overview

The State is served by eighteen telephone companies. In the process of conducting the inventory phase we talked to those service providers and infrastructure owners and operators who serve a surveyed community directly, as well as to those who had indicated plans to extend their transport infrastructure and/or services to the surveyed communities.

Exhibit B.1 provides information matching the surveyed communities with the Incumbent Local Exchange Carrier (the local telephone company) and other infrastructure owners and operators who expressed plans to serve the community in the future.

Exhibit B.1
ILECs and Other Infrastructure Owners

Surveyed Community	ILEC	Others Planning Transport
Flagstaff, Williams	Qwest	
Page	Qwest	Navajo Tribal Utility Authority
Parker	Verizon	
Sierra Vista	Qwest	Valley Telecom
Safford, Thatcher, Pima	Qwest	Valley Telecom, TeleSpectra
Show Low, Pinetop-Lakeside, Taylor, Snowflake	Frontier Communications	TeleSpectra
Hopi Tribe	Century Tel	
Navajo Nation	Navajo Communications	Navajo Tribal Utility Authority

Following is a brief analysis of each major service provider and infrastructure owner and operator.

B.2 ILECs

Qwest

Qwest Communications is headquartered in Denver, CO. The company acquired the assets of US West in 2000. These assets included the service areas of the two major metropolitan communities in Arizona, Phoenix and Tucson, as well as Flagstaff, Sierra Vista and a number of rural exchanges, including Safford and Pima, Williams and Page.

Qwest Communications undertook to sell the rural exchanges to Citizen Communications in 2001. This sale subsequently did not materialize, however, during this period Qwest did not invest in the upkeep and expansion of its transport network into these exchanges nor of the local distribution plant within these exchanges, leading to facility shortages adversely affecting the availability of telecommunications services in these exchanges.

Qwest is in a capital crunch. Discussions with the carrier established that, despite earlier commitments, capital projects to increase transport and local distribution capacities in affected exchanges will not proceed. A date for relief has not been provided.

The lack of funds to increase transport capacity not only affects the exchanges in Qwest territory but also those in independent telephone company areas which rely on traffic interchange capacity from Qwest. Especially hard hit in this respect is the White Mountain region of the communities of Show Low, Pinetop-Lakeside, Taylor and Snowflake served by Frontier Communications.

After the merger with US West, Qwest moved most line operation functions such as customer circuit engineering and customer service to its head office location Denver, CO. In discussions with community stake holders, this was a major irritant since in many cases the people dealing with local requests for services were not aware of local capabilities. Qwest is now in the process of moving these functions back into the communities.

Of the surveyed communities, Qwest serves Flagstaff, Williams and Page in Coconino County, Sierra Vista in Cochise County, and the communities of Safford, Thatcher, Pima in Graham County.

Exhibit B.2
Qwest Exchanges in the Surveyed Communities

Surveyed Community	Qwest Exchanges
Flagstaff	Flagstaff Main
	Flagstaff East
Williams	Williams
Page	Page
Sierra Vista	Sierra Vista Main
	Sierra Vista South
Safford, Thatcher	Safford
Pima	Pima

Qwest's transport network serving the surveyed communities consists of fiber between Phoenix and Flagstaff and digital radio between Benson/Wilcox and Safford, Benson to Sierra Vista and Flagstaff to Page. There is sufficient capacity on the Phoenix to Flagstaff cross section, however, there is no redundant path and damage to the fiber optic cable in 2001 resulted in a lengthy outage. The digital radio links to the other surveyed communities are completely filled and service orders from Sierra Vista, Safford and Page are usually held until transport capacity becomes available through off-setting service cancellations and changes. In addition, Qwest interfaces with Frontier Communications in Holbrook carrying traffic into and out of the White Mountain region (Show Low, Pinetop-Lakeside, Taylor and Snowflake). This link is filled as well and transport capacity out of this region is constrained.

Except for Flagstaff, Williams and Page, local distribution plant in the other exchanges operated by Qwest has not been kept up-to-date and there are some shortages to specific areas in Sierra Vista, while in Safford the unavailability of local distribution facilities generally has reached critical levels. Qwest operates point-to-point fiber in all exchanges, except Page and Williams.

Frontier Communications

Frontier Communications is owned by Citizens Communications headquartered in Salt Lake City, UT. Citizen Communications refused to provide data on their network and services and obviously did not understand the intent and purpose of the study. All infrastructure information has been obtained from other sources and has been corroborated with local stakeholders.

Frontier operates three exchanges in the White Mountain region:

- Pinetop-Lakeside;
- Show Low; and
- Snowflake serving Snowflake and Taylor.

The company is offering ADSL service in Show Low and Pinetop-Lakeside. This service is not yet offered in Snowflake and Taylor, and roll-out appears to be on hold due to unavailability of transport capacity to the region.

Frontier does not experience any local distribution facility constraint as encountered in several rural exchanges operated by Qwest. There are several local dedicated fiber cable runs to specific customers, however, details have not been provided.

Navajo Communications

Navajo Communications headquartered in Window Rock, AZ is also owned by Citizens Communications. Again, information has been obtained from other sources since Citizens refused to provide infrastructure related data.

The company serves the Navajo Nation and operates the following exchanges in Arizona:

▪ WINDOW ROCK	▪ MANY FARMS
▪ BLACK MESA	▪ PINON-COTTONWOOD
▪ CHINLE	▪ RED VALLEY
▪ DILCON	▪ ROUGH ROCK
▪ DENNEHOTSO	▪ ROCK POINT
▪ FORT DEFIANCE	▪ SHONTO
▪ GANADO	▪ TUBA CITY
▪ GREASEWOOD	▪ TEEC-NOS-POS
▪ KAIBETO	▪ TOYEI
▪ KAYENTA	▪ TSAILE
▪ LE CHEE	▪ WIDE RUINS
▪ LUKACHUKAI	

Navajo Communications offers ADSL service in several exchanges within the distance limitations of 18,000 feet loop length. These are:

▪ Window Rock	▪ Ganado	▪ Kayenta
▪ Fort Defiance	▪ Shiprock (NM)	▪ Tsaile
▪ Navajo	▪ Chinle	▪ Tuba City
▪ Tse Bonito (NM)	▪ Piñon	

Transport between most of these exchanges consists of a DS-3 digital radio network.

Century Telephone of the Southwest, Inc.

Century Telephone of the Southwest, Inc., headquartered in Monroe, LA provides services to the Hopi Tribe. The company provides basic telephone services and T-1 data services within the territory.

There are no plans to introduce high-speed Internet access to end users.

Verizon

Verizon serves LATA 730 which extends from California into La Paz County including Parker. Transport into Parker is provided over a DS-3 digital radio link. Local distribution in Parker is primarily via copper loops.

Verizon does not offer ADSL Internet access services in Parker and has no plans to do so in the near future.

B.3 Other Transport Infrastructure Owners***Valley Telecom***

Valley Telecom is a local exchange cooperative operating a number of telephone exchanges along I-10 between Tucson, AZ and El Paso, TX, none of which include the surveyed communities. The company is headquartered in Wilcox, AZ.

The company is in the process of installing fiber optics cable facilities to Safford by December 2002 and to Sierra Vista by June 2003.

In addition, Valley Telecom is preparing an application to the ACC to allow it to provide basic services in both exchanges. This application is expected to be filed by December 2002 and a decision made by June 2003. The company does not intend to duplicate local copper plant in both exchanges and is looking at other access technologies, such as MMDS and LMDS.

A fiber extension by Valley Telecom into these communities will alleviate the transport constraint they currently experience.

TeleSpectra

Telespectra operates out of Phoenix, AZ. Parts of their network consist of microwave radio systems purchased from MCI. Much of their network is analogue, but they are embarked on a digital upgrade program. A significant element of their business is delivering television feeds to cable company head ends; e.g., Page. The demand from their cable company customers for digital connectivity for Internet services is moving Telespectra to digitize their network.

Telespectra defines its mission as carrying traffic to and from rural communities. It is basically a backbone provider connecting traffic to a central hub in Phoenix. The company does provide some point-point connectivity, an example being the NAU Net that hubs traffic to Flagstaff and traffic for cellular service providers. The focus is on T1 to DS3, with DS-3 the preferred level of interconnection to customers. Connectivity to the Internet is via Winstar and MCI, but Telespectra does not operate as an ISP. They use “partners” to deliver local distribution service to end-customers.

Telespectra’s pricing strategy is based on cost-based prices, but prices that also reflect a premium value where they are the sole service provider. Their prices can be higher than comparable prices from Qwest in these areas. The master plan is to digitize Arizona in the next three years.

Electric Lightwave, Inc.

Electric Lightwave operates fiber optics facilities throughout the Southwest and offers transport services within Southwest FiberNet. The company is owned by Citizen Communications in Salt Lake City, UT.

In Arizona, the fiber facilities extend from Phoenix through Kingman to Las Vegas, however, do not touch any of the surveyed communities. The company has no plans to extend their fiber optics network to any of these communities including Flagstaff, due to a lack of demand.

B.4 Arizona Power Companies

Arizona Public Service (APS)

APS operates a DS-3 digital radio network linking its various generating and distribution stations throughout the State. None of these locations are within the territories covered by the surveyed communities, however, a DS-3 link is extending to the Coronado generating station near St. Johns. St. Johns is located in Apache County, within the operating territory of Frontier Communications and this link hypothetically could be extended to provide transport to the communities of Show Low, Pinetop-Lakeside, Snowflake and Taylor.

Some capacity on this DS-3 link is currently used by cybertrails, an ISP which was originally started by APS but had subsequently separated from APS and is now operating independently. In discussions with cybertrails, the service provider told us that alternate transport facilities are being established through a patchwork of fiber optics facilities provided by Qwest, AT&T and Frontier and that the DS-3 facilities provided by APS would then be released. At that time some additional transport capacity could be provided over the released facilities via a link between the generating station and the White Mountain region.

Salt River Project (SRP)

SRP operates a digital radio and fiber optics network linking its various generating and distribution stations throughout the State. None of these locations are within the territories covered by the surveyed communities and SRP's long distance network has therefore not been considered in the review of capabilities in the surveyed communities.

Navajo Tribal Utility Authority (NTUA)

The Navajo Tribal Utility Authority is operating an extensive digital radio network linking its various generating and distribution sites with the Navajo Nation. NTUA is currently in the process of expanding these links to provide OC-3 capacity between Shiprock, NM and Black Mesa, AZ. DS-3 radio links extend from Black Mesa to Preston Mesa and Mount Elden in Flagstaff with a DS-3 link planned to Tuba City in Coconino County. Exhibit 6.3 provides more details.

NTUA is open to lease spare capacity on this network.

B.5 Cable Companies**Cox Cable**

Cox Cable, headquartered in Atlanta, GA, serves the community of Sierra Vista in addition to several other communities within Arizona. The cable plant has recently been upgraded to allow two-way communications. Currently, the upgraded plant is primarily used to provide digital cable TV services, but it will be available for cable modem Internet traffic once the transport constraint by Qwest carrying traffic out of and into Sierra Vista has been remedied (expected January 2003).

Cable ONE

Cable ONE is headquartered in Phoenix, AZ. The company provides cable TV services in the surveyed communities of Safford, Thatcher and Pima in Graham County, Show Low, Pinetop-Lakeside, Taylor and Snowflake in Navajo County and in Page, Coconino County.

The cable plant has been upgraded to two-way communications in Graham County (Safford, Thatcher and Pima) and in the White Mountain region (Show Low, Pinetop-Lakeside, Taylor and Snowflake), however, not in Page.

Cable modem Internet access is currently offered in the White Mountain region, however, roll-out is controlled due to the transport constraint between Snowflake and Holbrook, the traffic interchange facilities between Frontier Communications and Qwest.

In the Safford area, the roll-out of cable modem services has been delayed twice and is now scheduled for September 2002 based on an expected relief of the capacity constraint on Qwest's transport network.

The cable plant in Page is one-way and there are currently no plans to upgrade the plant to two-way communications.

Flagstaff Cablevision and Parker Cablevision

Flagstaff Cablevision and Parker Cablevision, both owned by Cablevision headquartered in St. Joseph, MO are currently providing cable modem Internet access throughout their respective communities.

Navajo Cable Company

The Navajo Cable Company provides cable TV services throughout the Navajo Nation lands. The plant is completely one-way and there are no plans to upgrade to two-way communications allowing for cable modem Internet access.

B.6 Wireless Internet Service Providers and Other Infrastructure Owners

cybertrails

cybertrails was founded by APS and subsequently spun off by the power company. The company is serving major parts of Arizona utilizing the transport facilities of APS. Wireless access services are offered in only a number of the served communities. These include the Show Low, Snowflake area as described in the community description above.

CommSpeed

CommSpeed is a wireless Internet service provider in the Prescott Valley and Sedona area, operating primarily in the 5.8 and 6 GHz frequency ranges. The company is planning to extend its wireless access service network into Flagstaff and eventually on to Page, however, a specific timeframe was not provided.

Other Wireless ISPs

There are a number of wireless Internet access service providers operating in Arizona, mostly in the unlicensed 2.4GHz band. Most of these are local entrepreneurs and they are listed in the individual community write-ups above. None of these, with the exception of cybertrails and CommSpeed indicated any plans to extend services beyond their local coverage areas.

APPENDIX C

SECTORAL NETWORKS (MEDICAL, EDUCATION)

C.1 INTRODUCTION

There are a number of public sector “networks” in place that were reviewed with the purpose of assessing the potential for using them to meet identified community businesses and residential connectivity requirements.

In some cases, these “networks” are in reality not a telecommunications infrastructure in themselves, but rather are a public-sponsored organization designed to bring telecommunications connectivity and often related support services to mainly public sector entities. These networks in large use telecommunications services provided by private sector service providers.

An example of this is the Arizona State Public Information Network (ASPIN). This “network” has become an umbrella administration to facilitate Internet access for public sector-funded and non-profit entities and to assist in linking these entities to sources of grants for a large number of programs, with a focus on State educational organizations.

The conclusion is that these are specialized networks, and current acceptable use policies, suggest these are not currently suitable for meeting community needs. Shortfalls in high-speed Internet connectivity needs in the surveyed communities are mostly affecting businesses and residential end-users, groups that are not the current focus of these networks. However, future studies concerning the identification of potential solutions to fulfill the broadband connectivity needs of communities should examine the potential for leveraging certain of the existing public sector, particularly the more “facilities-centric” networks.

The medical sector and distance education “networks” may merit a closer look and are described in this appendix.

C.2 MEDICAL SECTOR

Four networks that are specific to the medical sector have been identified as follows:

- University of Arizona Western Regional Telehealth Network
- Arizona Telemedicine Program
- NARBHA
- Northern Arizona Regional Behavioral Health Authority
- IHS
- Indian Health Services
- Banner Health

Three of these networks are owned and operated by the organization itself. Those networks are the U of A Western Regional Telehealth Network, NARBHA and Banner Health. The Indian Health Services network is billed to them and therefore “owned” by them, but the U of A Western Regional Telehealth Network operates and monitors the network for IHS.

The underlying carriers for each of the networks varies. The U of A Western Regional Telehealth Network uses Electric Lightwave (ELI), Winstar, and Qwest. NARBHA uses Qwest and the U of A Western Regional Telehealth Network. Indian Health Services uses Telespectra, Winstar, Citizens/Navajo Communications, Qwest and the U of A Western Regional Telehealth Network. Banner Health uses Qwest and Sprint.

There are network diagrams available and attached for the U of A Western Regional Telehealth Network and NARBHA. These diagrams are available by accessing the following websites:

- <http://aztel.radiology.arizona.edu/RegionalTelehealthSystem/Default.htm>
- <http://www.narbha.org/agencies.htm>

The Indian Health Services network is attached and is also shown as part of the U of A Western Regional Telehealth network (NE corner of the diagram in blue). Banner Health did not supply a diagram and one is not available on their website.

University of Arizona Western Regional Telehealth Network

The U of A Western Regional Telehealth Network is a distributed ATM core network. The backbone is comprised of dedicated T1 and T3 circuits. The primary types of equipment used are the ASX-1200, ASX-1000 AND ASX-200BX ATM core switches, and Riverstone RS3000 routers co-located with select ATM switches. The WAN core supports circuit switched and IP applications. IP traffic is aggregated at selected Network Access Points (NAP) on the Riverstone RS3000 routers.

The cost to operate this network is \$500,000 per year (does not include IHS). Additional expense is incurred for the equipment maintenance, which is approximately \$65,000 per year. This program utilizes all of the funding resources available to them and is able to assist their customers and potential customers with acquiring funding as well.

The original core network was built with Arizona State funding. The Department of Agriculture Rural Utilities Service (RUS) will pay for equipment, but not for network. The National Telecommunications and Information Administration (NTIA) will fund some telecommunications network build out. However, the real key to their funding has been the Universal Service Fund. In addition to these resources, the University of Arizona Radiology Department subsidizes the program by providing all of the staff.

The U of A Western Regional Telehealth Network implemented a creative way for their customers and potential customers to “join” the network. They established a Membership Fee plan, essentially selling the services as a “Co-Op” arrangement. There is a fee schedule and discounts are available. The Membership Fee program combined with other available funding offsets 81% of the cost of network. To further assist in their cost containment for themselves and their customers, they entered into an equipment distributor agreement to obtain wholesale pricing.

The actual cost to End-Users is the Membership Fee of \$5,000 (not discounted). This includes the ATM edge device and the video equipment. The network monthly fees vary but are very reasonable.

The primary services provided over this network are video and data. They do offer an SLA for Teleradiology which is a 24 x 7 guarantee with a 30 minute turnaround, and they process about 2,000 cases per month. There are no other Service Level Agreements (SLA) or Quality of Service agreements available at this time. They have had minimal problems on their network.

The Acceptable Usage Policy for the U of A Western Regional Telehealth Network is for video and data applications only for now. Adding voice services would be considered carefully due to the network prioritization needed on the network, the inherent Quality of Service issues, and the possible bandwidth and equipment issues.

The network and program is open to medical and educational opportunities including some non-medicine distance learning applications. They will consider each customer opportunity on an individual case basis.

The future plans for the U of A Western Regional Telehealth Network include evaluation of becoming an Internet Service Provider (ISP) and a Competitive Local Exchange Carrier (CLEC). Both of these opportunities present different challenges.

They are branching out on a National level through the National Telehealth/Telemedicine Emergency Network. This includes potential partners in California, Hawaii, Utah, Oregon, Washington, South Dakota, Wyoming, Montana, and Alaska. Other projects they have been implementing are as follows:

- Navajo Area Indian Health Service (NAIHS) Telehealth Network
- 90% Operational

- Phoenix Area Indian Health Service (PAIHS) Telehealth Network
- Phase 1 on order – DS3 from Phoenix to Las Vegas through Kingman.

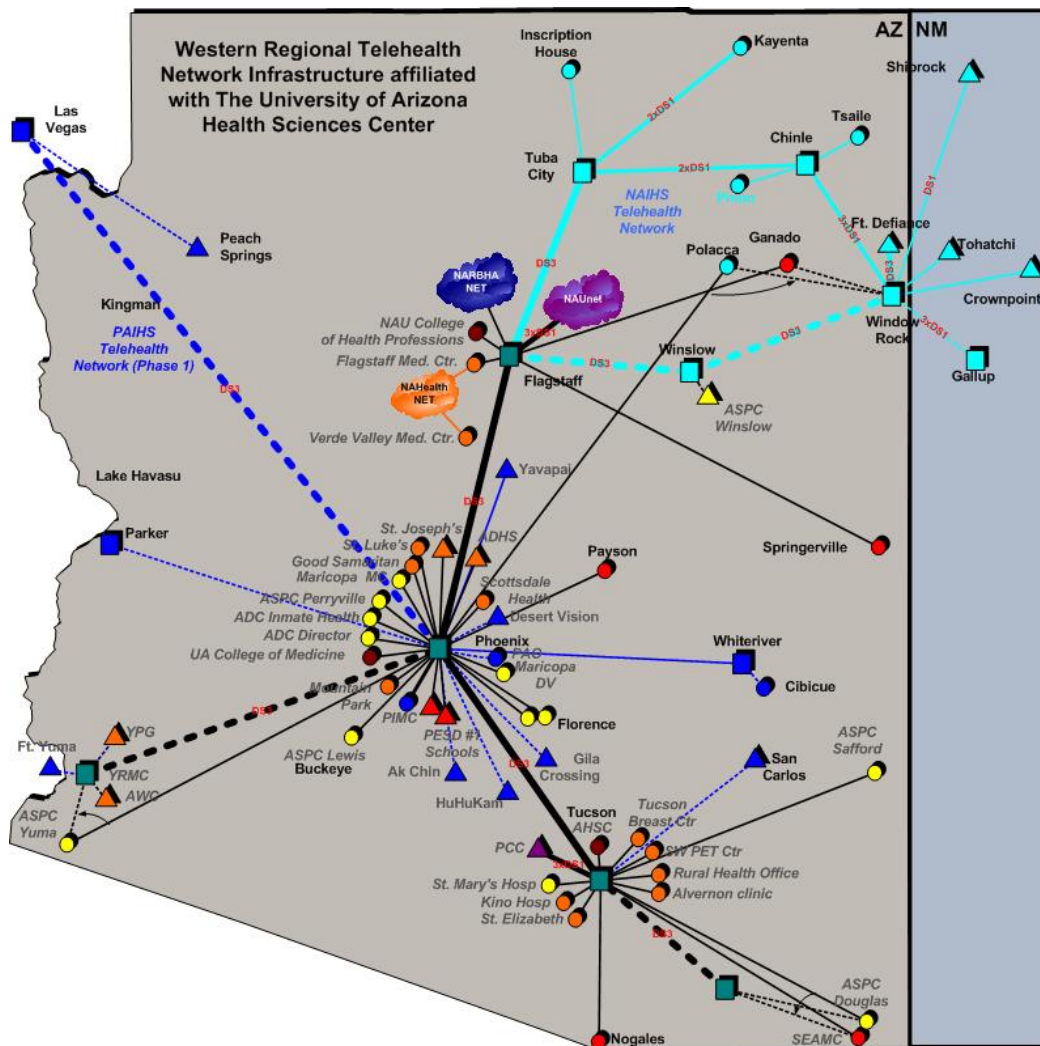
- Regional Planning
- Purpose is to reduce barriers and cost by creating sub-regional access points.
- Would be available for Telehealth/Telemedicine/Education.

- SE Arizona
- Creation of a sub-regional NAP in Sierra Vista – work has not progressed.

- SW Arizona
- Funding obtained to extend the backbone to Yuma via DS3.

- Colorado River
- Plan has been developed for a microwave link along the river. Applications made for grant money – pending.

The information for the U of A Western Regional Telehealth Network was provided by an in person interview with Kevin M. McNeill, Ph.D., CIO Arizona Telemedicine Program, Co-Director, Teleradiology Section, Department of Radiology, The University of Arizona Health Sciences Center, Tucson, AZ. Other detailed information and diagrams are located at <http://aztel.radiology.arizona.edu/RegionalTelehealthSystem/Default.htm>



Northern Arizona Regional Behavioral Health Authority (NARBHA)

NARBHA's mission is to provide behavioral health programs for eligible persons in the northern Arizona counties of Apache, Coconino, Mohave, Navajo and Yavapai including all Native American lands except the Navajo Nation. They built a dedicated network primarily for videoconferencing. They use dedicated T1 circuits and switched PRI for dial-up service on their video network. They currently operate one video MCU in Flagstaff. The original videoconferencing equipment is CLI (installed in 1996-1997) but this equipment is reaching its end of life. The equipment chosen to replace the CLI and for new installations is the Polycom Viewstation FX video equipment. The cost to operate the entire network is hard to determine. Each End User pays for the dedicated T1 circuit and the maintenance and support service agreement on the equipment.

The initial funding for the telemedicine system was received from the Arizona Department of Health Services. They still receive supplemental funding from various sources. When a new organization is brought into NARBHA net, NARBHA buys the initial equipment and gives it to the end user with the understanding that the end user will pay the ongoing monthly and maintenance costs.

Their current partnerships and connections to other networks are with the Community Partnership of Southern Arizona (CPSA), Arizona Telemedicine Program (U of A Western Region Telehealth Network), Pinal Gila Behavioral Health Association (PGBHA) and the Excel Group. NARBHA administers this as one seamless telehealth network.

CPSA provides services to Tucson, Benson, Douglas, Sierra Vista, Nogales, and Safford. PGBHA provides services to Apache Junction, Kearny, Casa Grande, Globe, Eloy, Payson and Oracle. PGBHA also provides a direct connection to the Department of Health Services/Behavioral Health Services hub in Phoenix. The Excel Group serves La Paz and Yuma counties.

NARBHA does not provide any Service Level Agreements (SLA) or Quality of Service agreements.

The current network is for Video and Data applications only. Voice services will not be considered at this time. NARBHA does have bill back ability for use of their videoconferencing room and services and will consider working with individuals and/or organizations to rent out their facilities, especially during off-hours (evening and weekends). They are open to opportunities from customers wanting Clinical, Distance Learning, or Administration applications. They will consider each opportunity on an individual case basis.

NARBHA is currently upgrading their Flagstaff to Phoenix backbone from T1 to T3. The order is pending with Qwest.

This information was provided through a telephone interview with Keith Duerr, Telemedicine Program Manager, Northern Arizona Regional Behavioral Health Authority, Flagstaff, AZ. Detailed information and diagrams are located at <http://www.narbha.org/agencies.htm>.

Indian Health Services

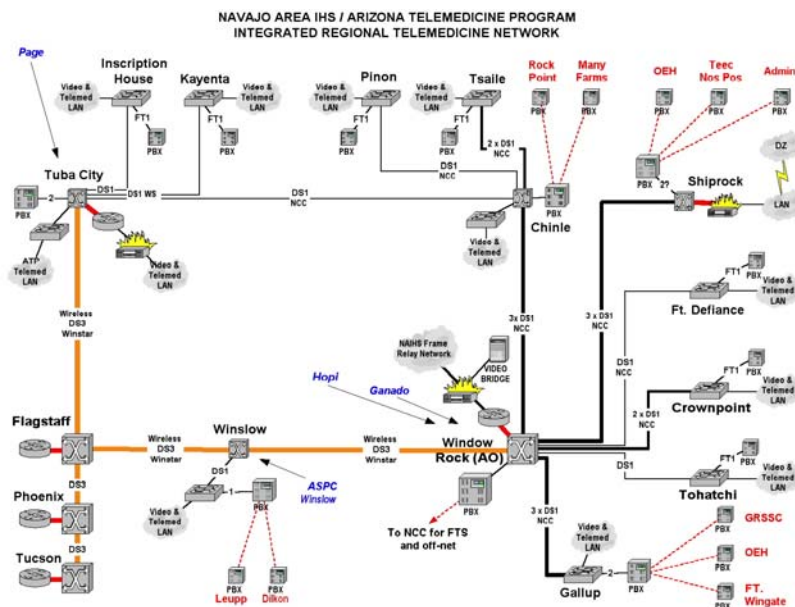
The Indian Health Services organization uses dedicated T1 and T3, satellite, wireless and microwave technologies. Their equipment brands are unknown but the types of equipment are noted on the diagram.

The cost for them to operate the network is unknown except that they are part of the U of A Western Regional Telehealth Network and pay membership fees. The U of A Western Regional Telehealth Network manages the IHS network.

The cost to end users is unknown and Service Level Agreements and Quality of Service agreements are also unknown.

Indian Health Services is upgrading their network with a new T3 connection from Flagstaff to Window Rock via Winslow. This service is on order through Winstar.

The information regarding the Indian Health Services (IHS) network was provided primarily by Kevin M. McNeill of the U of A Western Regional Telehealth Network. No contact was made with Indian Health Services directly.



Banner Health

Banner Health provides network connectivity in Arizona, Colorado and Arkansas. They use a variety of WAN technologies with services provided primarily by Qwest (AZ & CO) and Sprint. They are currently in the process of converting the network equipment from 3Com to Cisco equipment. The types of circuits used are 56Kbps, Frame Relay, Dedicated T1, Dedicated T3, and OC12 SONET.

The Arizona network is comprised of 814 network switches, 19,000 active ports for PC's, printers & other devices. There are 68 routers and core switches. There are 119 data circuits. They currently run voice, video and data on several portions of the existing network.

The cost to operate their entire data network is one million dollars per year.

The cost to their end users is calculated by Corporate Services. They use a formula that allocates costs back to regions and departments.

Banner Health does not provide users with any Service Level Agreements or Quality of Service agreements.

Banner Health does not offer their network to other providers. They consider it a private network.

Information on the Banner Health network was via email with Marshall (Mark) Smith, MD, Ph.D., Medical Director of Telemedicine, Good Samaritan Regional Medical Center, Phoenix, AZ and his IT department.

C.3 EDUCATION SECTOR (DISTANCE EDUCATION)

Northern Arizona University

There are two networks provided under the auspices of NAU and Arizona University – the NAU Internet and NAUNet. The latter is predominantly a video conferencing network, but it has some limited data connectivity capability as well.

Since 1990 the NAU Internet has been extending Internet access to community colleges, K-12 schools, non-profit entities, government entities, cities and counties. (See <http://aspin.asu.edu/about/mission.html> for the mission statement for ASPIN.) As an Internet service provider, NAU Internet has dual-homed Internet access, a DS3 with AT&T (25 Meg) and an OC3 from Qwest (25 Meg) and a separate connection to Internet II via a 25 Meg circuit on the Qwest OC3 ATM. There are approximately 40 sites in the state that connect to the NAU Internet using Qwest IPVC circuits. (A network diagram is available at http://www.tel.nau.edu/network/topology/Internet20002_frame.htm)

NAUNet provides some modem pool connections using digital modems on its analog video conferencing network. (Discussed later) End-users pay for their access circuits to the NAU Internet and are charged \$250 per Megabyte of Internet access. The service is not eligible for the E-Rate subsidy.

NAUNet

“Northern Arizona University is charged by the Arizona Board of Regents to deliver quality upper-division courses and undergraduate programs to all rural and, where specifically authorized, metropolitan counties, and to provide graduate education programs throughout the state. NAUNet is a tool to help carry out this statewide charge. NAUNet is a cost-effective way to deliver quality instruction from the residential campus in Flagstaff to sites throughout the state. At some sites, NAUNet supplements instruction delivered by on-site faculty. At other sites, NAUNet is the primary means by which instruction is delivered.” “With 34 active sites, NAUNet is the only network in Arizona linking public education and state agency facilities to one another and to many of the state's C-band and Ku-band satellite up-link services, and providing direct links to most of Arizona's major television broadcasting stations and several cable companies.” (A site map of NAUNet is available at <http://www.nau.edu/naunet/nnsitemap.html>.)

The NAUNet is an analog network that is designed to carry high quality video conferencing sessions. The analog microwave radio equipment for the network has been provided by NAUNet and the network is operated for NAUNet by Telespectra. Digital capacity has been obtained over the analog network using T1 modems (\$7500 per end). The plan is to move to a digital service, but there are issues of the trade-off of delay and bandwidth to maintain the current video quality. At this point, the NAUNet group thinks that it needs 45 Mbps bandwidth to maintain the current and expected quality of the videoconferencing network – “studio quality”. This will be totally uneconomic and they are expecting that recent compression algorithms and codecs will provide a service quality that will become accepted as the standard. Telespectra is planning to upgrade its network to digital. (This was confirmed with Telespectra.) Pricing for the videoconferencing service is available on their Web site. Their service is available to outside groups at \$100/hr per location. The users use the existing equipped classrooms for the teleconference sessions.